

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

BMJ PUBLISHING GROUP LIMITED,

Petitioner,

v.

EVIDIUM, INC.,

Patent Owner.

Case No. PGR2027-00001

U.S. Patent No. 12,518,882

PETITION FOR POST GRANT REVIEW

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LISTING OF EXHIBITS

Exhibit No.	Description
1001	U.S. Patent No. 12,518,882 (“the ‘882 patent”)
1002	File History of the ‘882 patent
1003	Declaration of Mark Alan Musen, M.D., Ph.D.
1004	Curriculum Vitae of Mark Alan Musen, M.D., Ph.D.
1005	U.S. Patent Publication No. 2019/0252074 (“Datla”)
1006	U.S. Patent No. 11,636,949 (“Goldberg”)
1007	U.S. Patent No. 12,248,826 (“Gnanasambandam”)
1008	U.S. Patent Publication No. 2022/0208373 (“Dang”)
1009	U.S. Patent No. 11,194,860 (“Zhong”)
1010	Eryu Xia et al., “Mining Disease-Symptom Relation from Massive Biomedical Literature and Its Application in Severe Disease Diagnosis,” IBM Research (2018) (“Xia”)
1011	U.S. Patent Publication No. 2021/0233658 (“Van Assel”)
1012	U.S. Patent Publication No. 2024/0221952 (“Kim”)
1013	J. MacRae et al., Access primary care Big Data: the development of a software algorithm to explore the rich content of consultation records, BMJ Open (2015) (downloaded from https://pmc.ncbi.nlm.nih.gov/articles/PMC4550741/pdf/bmjopen-2015-008160.pdf) (“MacRae”)
1014	File History of U.S. Patent Application No. 19/092,400
1015	<i>Evidium, Inc. v. BMJ Publishing Group Limited</i> , Case No. 4:26-cv-05050-AMO (N.D. Cal.) (Dkt. 1) (May 28, 2026) (Complaint –

Exhibit No.	Description
	Redacted Version)
1016	<i>Evidium, Inc. v. BMJ Publishing Group Limited</i> , Case No. 4:26-cv-05050-AMO (N.D. Cal.) (Dkt. 30) (Sept. 3, 2026) (Amended Complaint – Redacted Version)
1017	<i>Evidium, Inc. v. BMJ Publishing Group Limited</i> , Case No. 4:26-cv-05050-AMO (N.D. Cal.) (Dkt. 30-16) (Amended Complaint Ex. P – Claim Chart for U.S. Patent No. 12,518,882)
1018	<i>Evidium, Inc. v. BMJ Publishing Group Limited</i> , Case No. 4:26-cv-05050-AMO (N.D. Cal.) (Dkt. 15) Proof of Service of Summons
1019	<i>Evidium, Inc. v. BMJ Publishing Group Limited</i> , Case No. 4:26-cv-05050-AMO (N.D. Cal.) (Dkt. 30-16) (Amended Complaint Ex. P – Claim Chart for U.S. Patent No. 12,518,882) (Excerpted)
1020	U.S. Patent Publication No. 2022/0310260 (“Ullaskrishnan”)
1021	U.S. Patent Publication No. 2019/0026437 (“Syeda-Mahmood”)
1022	U.S. Patent No. 12,512,193 (“Marcjan”)
1023	U.S. Patent Publication No. 2023/0377748 (“Yang”)
1024	U.S. Patent No. 11,488,713 (“Velez”)
1025	U.S. Patent Publication No. 2018/0108443 (“Li”)
1026	U.S. Patent No. 12,014,135 (“Potts”)
1027	U.S. Patent No. 7,260,480 (“Brown”)
1028	Dan McCreary, Knowledge Graphs: The Third Era of Computing, Medium (Mar. 23, 2019) (https://dmccreary.medium.com/knowledge-graphs-the-third-era-of-computing-a8106f343450)

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1029	“DocKG: A Knowledge Graph Framework for Health with Doctor-in-the-Loop,” Ming Sheng et al. (“Sheng”)
1030	“Learning a Health Knowledge Graph from Electronic Medical Records,” Maya Rotmensch et al. (July 20, 2017) (“Rotmensch”)
1031	“Semantic Health Knowledge Graph: Semantic Integration of Heterogeneous Medical Knowledge and Services,” Longxiang Shi et al. (Feb. 12, 2017) (“Shi”)
1032	“Clinical Decision-Support Systems,” Mark A. Musen et al. (2021) (“Musen Textbook”)
1033	“Artificial Intelligence in Medical Diagnosis,” Peter Szolovits et al. (1988) (“Szolovits”)
1034	“ <i>Internist-I</i> , An Experimental Computer-Based Diagnostic Consultant for General Internal Medicine,” Randolph A. Miller et al. (1982) (“Miller”)
1035	“INTERNIST-I Properties: Representing Common Sense and Good Medical Practice in a Computerized Medical Knowledge Base,” Fred E. Masarie et al., Computers and Biomedical Research (1985) (“Masarie”)
1036	“Towards computer-assisted maintenance of medical knowledge bases,” Dario A. Giuse, Artificial Intelligence in Medicine (1990) (“Giuse”)
1037	“Automated Encoding of Clinical Documents Based on Natural Language Processing,” Carol Friedman et al. (2004) (“Friedman”)
1038	SNOMED CT Starter Guide (Version 2014-12-02) (Dec. 2014) (https://web.archive.org/web/20160718140111/http://doc.ihtsdo.org/download/doc_StarterGuide_Current-en-US_INT_20141202.pdf)

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1039	About LOINC, LOINC from Regenstrief (https://web.archive.org/web/20220125211233/https://loinc.org/about)
1040	Mark Musen et al., “The National Center for Biomedical Ontology,” Journal of the American Medical Informatics Association (2012)
1041	Natalya Noy et al., “BioPortal: ontologies and integrated data resources at the click of a mouse,” Nucleic Acids Research, 2009, Vol. 37 (May 2009)
1042	History of The BMJ (https://www.bmj.com/about-bmj/history-of-the-bmj)
1043	About – PubMed (https://web.archive.org/web/20200309080055/https://pubmed.ncbi.nlm.nih.gov/about/)
1044	BioPortal API Documentation (https://web.archive.org/web/20140725213752/http://data.bioontology.org/documentation)
1045	Declaration of Kamran Abbasi
1046	https://bmjopen.bmj.com/content/5/8/e008160
1047	https://bmjopen.bmj.com/content/5/8/e008160.info
1048	https://bmjopen.bmj.com/content/5/8/e008160.altmetrics
1049	https://web.archive.org/web/20180602195259/http://bmjopen.bmj.com/content/5/8/e008160

LISTING OF CLAIMS

U.S. Patent No. 12,518,882

Independent Claim 1

Identifier	Claim Language
[1pre]	A computer system for integrating medical evidence text into a computational form, said computer system comprising
[1a]	one or more processors; and memory that stores instructions, wherein the instructions, when executed by the one or more processors, cause the one or more processors to
[1b]	receive electronic text in a plurality of medical evidence sources, said electronic text pertaining to a plurality of medical conditions, wherein at least a subset of said medical evidence sources includes a published journal
[1c]	retrieve a plurality of diagnostic factors that are associated with one or more of said plurality of medical conditions
[1d]	wherein said medical evidence sources provide different taxonomies that arrange one or more of said diagnostic factors and/or one or more of said medical conditions in different hierarchies, and wherein a first diagnostic factor is discussed in part of said electronic text as being indicative of a first medical condition
[1e]	create a graph database cross-linking said one or more diagnostic factors and said one or more medical conditions that are arranged in different hierarchies in said medical evidence sources
[1f]	store said one or more diagnostic factors and said one or more medical conditions that are cross linked as separate entries in said graph database, wherein a first entry of said first diagnostic factor indicative of said first medical condition is linked to a second entry of said first medical condition in said graph database

[1g]	wherein said first entry of said first diagnostic factor in said graph database does not include information specific to said first medical condition represented by said second entry
[1h]	establish one or more application programming interfaces (APIs) for said graph database, said one or more APIs allowing an application to integrate with said graph database to access said separate entries that are linked in said graph database in order to generate a healthcare determination

Dependent Claim 2

Identifier	Claim Language
2	A computer system as recited in claim 1, wherein the instructions, when executed, further cause the one or more processors to: display on a computing device a portion of said graph database which includes said second entry of said first medical condition and each of said diagnostic factor entries and the links between said second entry and said diagnostic factor entries.

Dependent Claim 3

Identifier	Claim Language
3	A computer system as recited in claim 1 wherein said each separate entry in said graph database is a node.

Dependent Claim 4

Identifier	Claim Language
4	A computer system as recited in claim 1 wherein said each diagnostic factor entry includes a unique identifier which links to an

	entry in a medical ontology representing said each diagnostic factor.
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Dependent Claim 5

Identifier	Claim Language
5	A computer system as recited in claim 1 wherein said each diagnostic factor entry includes at least one synonym of said diagnostic factor represented by said each diagnostic factor entry.

Dependent Claim 6

Identifier	Claim Language
6	A computer system as recited in claim 1 wherein said each diagnostic factor entry includes a temporality attribute, a negation attribute or an experienter attribute.

Dependent Claim 7

Identifier	Claim Language
7	A computer system as recited in claim 1, wherein the instructions, when executed, further cause the one or more processors to: receive input from a person via a computing device indicating a demographics corresponding to one of said diagnostic factors, said demographics indicating a type of person to which said one of said diagnostic factors occurs in the context of said one or more medical conditions; and store said demographics in a demographics entry linked between one of said medical condition entries and one of said diagnostic factors entries representing said one of said diagnostic factors.

Dependent Claim 8

Identifier	Claim Language
8	A computer system as recited in claim 1, wherein at least one of said diagnostic factors for a second medical condition being the same as one of said diagnostic factors for said first medical condition, wherein said second medical condition being linked to said at least one diagnostic factor and said first medical condition being linked to said at least one diagnostic factor.

Dependent Claim 9

Identifier	Claim Language
9	A computer system as recited in claim 8 wherein traversing said graph database from said at least one diagnostic factor to said second medical condition produces a second rank for said at least one diagnostic factor in the context of said second medical condition which is different from a first rank produced by traversing from said at least one diagnostic factor to said first medical condition.

Dependent Claim 11

Identifier	Claim Language
11	A computer system as recited in claim 1 wherein the instructions, when executed, further cause the one or more processors to: retrieve at least one laboratory test that is associated with one or more of said plurality of medical conditions; and store said laboratory test as a separate entry in said graph database, one of said medical conditions being linked to said laboratory test, wherein an entry of said laboratory test in said graph database does not include information specific to said medical condition linked to said

	laboratory test.
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Dependent Claim 12

Identifier	Claim Language
12	A computer system as recited in claim 1 wherein said graph database includes more than twenty thousand entries.

Dependent Claim 13

Identifier	Claim Language
13	A computer system as recited in claim 1 wherein said graph database includes more than one hundred thousand entries.

Dependent Claim 14

Identifier	Claim Language
14	A computer system as recited in claim 1 wherein said healthcare determination is a recommendation, an evaluation, a result, or a conclusion.

Independent Claim 15

Identifier	Claim Language
[15pre]	A computer system for determining a state of a patient, said computer system comprising
[15a]	one or more processors; and memory that stores instructions, wherein the instructions, when executed by the one or more

	processors, cause the one or more processors to
[15b]	extract from a plurality of medical evidence sources a plurality of diagnostic factors that are indicative of one or more of a plurality of medical conditions
[15c]	wherein at least a subset of said medical evidence sources includes a published journal and wherein said medical evidence sources provide different taxonomies that arrange one or more of said diagnostic factors and/or one or more of said medical conditions in different hierarchies, and wherein a first diagnostic factor is discussed in part of said medical evidence sources as being indicative of a first medical condition
[15d]	create a graph database cross linking said one or more diagnostic factors and said one or more medical conditions that are arranged in different hierarchies in said medical evidence sources
[15e]	store each of said diagnostic factors and said medical conditions that are cross linked as its own node in said graph database, said one or more medical conditions being linked to said diagnostic factors, wherein each of said diagnostic factor nodes do not include information specific to said medical conditions
[15f]	for at least one of said diagnostic factors, store demographics required to indicate one of said medical conditions on the basis of said at least one diagnostic factor in a demographics node located between said one of said medical condition nodes and a node representing said at least one diagnostic factor
[15g]	establish one or more application programming interfaces (APIs) for said graph database, said one or more APIs allowing an application to integrate with said graph database to access said diagnostic factors and said medical conditions that are linked in said graph database in order to generate a healthcare determination
[15h]	match patient data from a patient medical chart to at least one of

	said diagnostic factor nodes and to said demographics node, in order to display said healthcare determination that said patient has one of said medical conditions.
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Dependent Claim 16

Identifier	Claim Language
16	A computer system as recited in claim 15, wherein the instructions, when executed, further cause the one or more processors to: determine a rank of said likelihood that said patient has one of said medical conditions by reference to a node intermediate between one of said medical condition nodes and said diagnostic factor nodes that holds said rank of said diagnostic factors.

Dependent Claim 17

Identifier	Claim Language
17	A computer system as recited in claim 15, wherein the instructions, when executed, further cause the one or more processors to: perform said extract said plurality of diagnostic factors using natural language processing (NLP) that is initialized using existing diagnostic factor nodes of said graph database.

Dependent Claim 18

Identifier	Claim Language
18	A computer system as recited in claim 15 wherein said graph database includes more than twenty thousand nodes.

Dependent Claim 19

Identifier	Claim Language
19	A computer system as recited in claim 15 wherein said graph database includes more than one hundred thousand nodes.

Dependent Claim 20

Identifier	Claim Language
20	A computer system as recited in claim 15 wherein said healthcare determination is a recommendation, an evaluation, a result, or a conclusion.

Independent Claim 21

Identifier	Claim Language
[21pre]	A computer system for determining a state of a patient, said computer system comprising
[21a]	one or more processors; and memory that stores instructions, wherein the instructions, when executed by the one or more processors, cause the one or more processors to
[21b]	receive a portion of a patient electronic health record (EHR) to produce a plurality of diagnostic factors known to be present or absent in said patient
[21c]	match said diagnostic factors to entries in a graph database that represent said diagnostic factors
[21d]	each of said diagnostic factor entries being cross linked to at least one medical condition entry in said graph database representing a medical condition and not including information specific to said medical condition to which said each diagnostic factor entry is linked

[21e]	wherein said diagnostic factor entries and said medical condition entries originate in at least one medical evidence journal
[21f]	wherein said at least one medical evidence journal provides different taxonomies that arrange one or more of said diagnostic factors entries and/or one or more of said medical condition entries in different hierarchies
[21g]	wherein a first diagnostic factor entry is discussed in part of said at least one medical evidence journal as being indicative of a first medical condition entry
[21h]	establish one or more application programming interfaces (APIs) for said graph database, said one or more APIs allowing an application to integrate with said graph database to access said diagnostic factor entries and said medical condition entries in said graph database in order to generate a healthcare determination
[21i]	traverse a link from said each matched diagnostic factor entry to its linked medical condition and collecting a weight value indicative that said each matched diagnostic factor entry is caused by its linked medical condition
[21j]	sum all collected weight values for each linked medical condition to produce a total weight value for said each linked medical condition
[21k]	display on a computing device said linked medical conditions in order of total weight value as said healthcare determination

Dependent Claim 22

Identifier	Claim Language
22	A computer system as recited in claim 21, wherein the instructions, when executed, further cause the one or more processors to: display in association with each linked medical condition its corresponding

	total weight value.
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Dependent Claim 23

Identifier	Claim Language
23	A computer system as recited in claim 21, wherein the instructions, when executed, further cause the one or more processors to: for each present diagnostic factor, traverse upward in a medical ontology link found in said matched diagnostic factor entry in order to infer other diagnostic factors present in said patient and match these other diagnostic factors to other diagnostic factor entries in said graph database.

Dependent Claim 24

Identifier	Claim Language
24	A computer system as recited in claim 21 wherein each said diagnostic factor entry includes at least one synonym of said diagnostic factor.

Dependent Claim 25

Identifier	Claim Language
25	A computer system as recited in claim 21 wherein each said diagnostic factor entry includes a temporality attribute, a negation attribute or an experiencer attribute.

Dependent Claim 26

Identifier	Claim Language
26	A computer system as recited in claim 21, wherein the instructions, when executed, further cause the one or more processors to: produce said plurality of diagnostic factors using natural language processing (NLP); and initialize said natural language processing with said diagnostic entries of said graph database.

Dependent Claim 27

Identifier	Claim Language
27	A computer system as recited in claim 21 wherein a demographics entry of said graph database located between one of said matched diagnostic factor entries and its corresponding linked medical condition includes demographics of people who exhibit said matched diagnostic factor in the context of said linked medical condition, and wherein the instructions, when executed, further cause the one or more processors to: only traverse said link from said one matched diagnostic factor entry to its linked medical condition when information of said patient from said EHR matches said demographics in said demographics entry.

Dependent Claim 28

Identifier	Claim Language
28	A computer system as recited in claim 21 wherein said display is for the purpose of patient diagnosis, for an administrative medical purpose, or for a medical preauthorization.

Dependent Claim 29

Identifier	Claim Language
29	A computer system as recited in claim 21 wherein said graph database includes more than twenty thousand entries.

Dependent Claim 30

Identifier	Claim Language
30	A computer system as recited in claim 21 wherein said graph database includes more than one hundred thousand entries.

Dependent Claim 31

Identifier	Claim Language
31	A computer system as recited in claim 21 wherein said healthcare determination is a recommendation, an evaluation, a result, or a conclusion.

Independent Claim 32

Identifier	Claim Language
[32pre]	A computer system for determining next-best actions for a medical condition, said computer system comprising:
[32a]	one or more processors; and memory that stores instructions, wherein the instructions, when executed by the one or more processors, cause the one or more processors to
[32b]	for each medical condition of a patient having a probability greater than a threshold of being present in said patient, perform the

	following
[32c]	identify all known diagnostic factor entries in a graph database that each represent a diagnostic factor known to be present or absent in said patient
[32d]	each known diagnostic factor entry being linked to a medical condition entry in said graph database representing said each medical condition but not including information specific to said each medical condition
[32e]	identify all unknown diagnostic factor entries in said graph database that each represent an unknown diagnostic factor not known to be present or absent in said patient, each unknown diagnostic factor entry being linked to said medical condition entry
[32f]	wherein said known and unknown diagnostic factor entries and said medical condition entry originate in at least one medical evidence journal, wherein said at least one medical evidence journal provides different taxonomies that arrange one or more of said known and unknown diagnostic factors and/or one or more of said medical condition entries in different hierarchies, and wherein a first diagnostic factor entry is discussed in part of said at least one medical evidence journal as being indicative of a first medical condition entry
[32g]	establish one or more application programming interfaces (APIs) for said graph database, said one or more APIs allowing an application to integrate with said graph database to access said known and unknown diagnostic factor entries that are linked to said medical condition entry in said graph database in order to generate a healthcare determination
[32h]	identify a rank of each unknown diagnostic factor entry that indicates a likelihood that said represented unknown diagnostic factor indicates said each medical condition, said rank being stored in a database entry link between said unknown diagnostic factor

	entry and said medical condition entry
[32i]	display said unknown diagnostic factors represented by said unknown diagnostic factor entries in association with said each medical condition in order of said rank of said each unknown diagnostic factor as said healthcare determination

Dependent Claim 33

Identifier	Claim Language
33	A computer system as recited in claim 32, wherein the instructions, when executed, further cause the one or more processors to: identify said unknown diagnostic factor entries by traversing down through said graph database from said each medical condition entry and disregarding said known diagnostic factor entries.

Dependent Claim 34

Identifier	Claim Language
34	A computer system as recited in claim 32 wherein said rank of said each unknown diagnostic factor entry is located within a factor group entry located between said medical condition entry and said each unknown diagnostic factor entry.

Dependent Claim 35

Identifier	Claim Language
35	A computer system as recited in claim 32, wherein the instructions, when executed, further cause the one or more processors to: for each known diagnostic factor, traverse upward in a medical ontology link found in said identified known diagnostic factor entry in order to infer other known diagnostic factors present in said patient.

Dependent Claim 36

Identifier	Claim Language
36	A computer system as recited in claim 32 wherein each said known and unknown diagnostic factor entry includes at least one synonym of said represented known and unknown diagnostic factor.

Dependent Claim 37

Identifier	Claim Language
37	A computer system as recited in claim 32 wherein each said known and unknown diagnostic factor entry includes a temporality attribute, a negation attribute or an experiencer attribute.

Dependent Claim 38

Identifier	Claim Language
38	A computer system as recited in claim 32 wherein traversing said graph database from one of said unknown diagnostic factor entries to a first one of said medical conditions produces a first rank for said one of said unknown diagnostic factor entries in the context of said first medical condition which is different from a second rank

	produced by traversing from said one of said unknown diagnostic factor entries to a second one of said medical condition.
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Dependent Claim 39

Identifier	Claim Language
39	A computer system as recited in claim 32 wherein said graph database includes more than twenty thousand entries.

Dependent Claim 40

Identifier	Claim Language
40	A computer system as recited in claim 32 wherein said graph database includes more than one hundred thousand entries.

Dependent Claim 41

Identifier	Claim Language
41	A computer system as recited in claim 32 wherein said healthcare determination is a recommendation, an evaluation, a result, or a conclusion.

I. INTRODUCTION

Petitioner BMJ Publishing Group Limited (“Petitioner” or “BMJ”) requests post grant review of claims 1-9 and 11-41 (“challenged claims”) of U.S. Patent No. 12,518,882 (“’882 patent”).

II. COMPLIANCE WITH PGR REQUIREMENTS

A. Standing

Petitioner certifies that the ‘882 patent is an AIA patent available for PGR and that Petitioner is not barred or estopped from requesting PGR of the challenged claims on the grounds below. Petitioner has not filed a civil action challenging the validity of any claim of the ‘882 patent.

This petition is timely because it is filed within one year of service of Evidium’s infringement complaint against BMJ and within 9 months of the ‘882 patent’s January 6, 2026, issue date. 35 U.S.C. § 321(c); 37 C.F.R. § 42.202(a).

B. Mandatory Notices

1. Real Party-in-Interest

Petitioner BMJ Publishing Group Limited, which is wholly owned by the British Medical Association, is the real party-in-interest. No other party had access to or control over the Petition, and no other party funded or participated in preparation of this Petition.

2. Related Proceedings

The '882 patent is related to the following U.S. Patents: 11,869,674, 12,518,883, 12,300,392, 12,525,362, 12,542,217, 12,640,274, and 12,725,716 and pending U.S. Patent Application No. 19/722,113.

The '882 patent and certain related patents are at issue in *Evidium, Inc. v. BMJ Publishing Group Limited*, Case No. 4:26-cv-05050-AMO (N.D. Cal.) (“the NDCA Action”). EX1015; EX1016. The complaint was filed on May 28, 2026 (EX1015) and served on June 8, 2026 (EX1018).

3. Counsel and Service Information

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C. Payment of Fees

Pursuant to 37 C.F.R. § 42.15(b), the required fee is being submitted herewith. The Office is authorized to charge any deficiency, or credit overpayment, to Deposit Account No. 50-4181. Any additional fees due in connection with this Petition may be charged to the foregoing account.

III. IDENTIFICATION OF CHALLENGED CLAIMS

The challenged claims are claims 1-9 and 11-41.

No.	Claims	Unpatentability Ground
1	1-3, 8-9, 11-14	§103: Datla, Goldberg, and Gnanasambandam
2	4-5	§103: Datla, Goldberg, Gnanasambandam, Kim
3	6	§103: Datla, Goldberg, Gnanasambandam, Van Assel
4	7, 15-20	§103: Datla, Goldberg, Gnanasambandam, Dang
5	21-41	§112: Lack of Written Description
6	21-22, 26-31	§103: Datla, Dang, Gnanasambandam, MacRae
7	23-24	§103: Datla, Dang, Gnanasambandam, MacRae, Kim
8	25	§103: Datla, Dang, Gnanasambandam, MacRae, Van Assel
9	32-33, 38-41	§103: Zhong, Datla, Gnanasambandam, MacRae
10	34	§103: Zhong, Datla, Gnanasambandam, MacRae, Dang
11	35-36	§103: Zhong, Datla, Gnanasambandam, MacRae, Kim
12	37	§103: Zhong, Datla, Gnanasambandam, MacRae, Van Assel
13	1-9, 11-41	§101: Ineligible Subject Matter

Petitioner's challenges are supported by the declaration and testimony of Mark A. Musen, M.D., Ph.D. *See* EX1003 ¶¶1-27.

IV. TECHNICAL BACKGROUND

The '882 patent purports to transform unstructured medical evidence into a computational knowledge graph. But every technology the claims recite—standardized medical ontologies, medical knowledge graphs, clinical decision

support systems, and API-based access to medical knowledge—was well known before the priority date. EX1003 ¶57.

A. Medical Ontologies and Terminologies

A medical ontology is a structured, formal representation of medical concepts, such as conditions, findings, and investigations, and the relationships among them. EX1003 ¶58. Ontologies had been used for decades in clinical information systems, electronic health records (“EHRs”), and clinical decision support applications. *Id.*

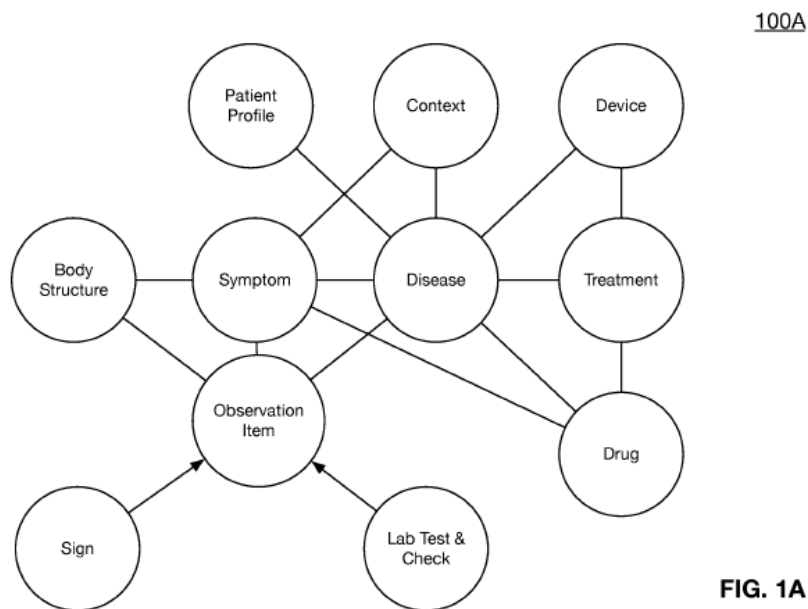
The Systematized Nomenclature of Medicine—Clinical Terms (“SNOMED-CT”) is among the most comprehensive and widely used clinical terminologies, and by 2022 contained hundreds of thousands of concepts organized in hierarchies. EX1003 ¶¶59-65; EX1006, 1:54-56, FIG. 6.

The Logical Observation Identifiers, Names, and Codes (“LOINC”) is a standard terminology for laboratory tests, clinical measurements, and related observations that, by 2022, included tens of thousands of codes. EX1003 ¶¶66-68. The ’882 patent acknowledges that SNOMED-CT and LOINC are pre-existing ontologies. EX1001, 5:16-18, 7:11-12, 20:31-40; EX1003 ¶68.

Many other terminologies, including ICD, RxNorm, the Gene Ontology, and MeSH, were also in wide use, and the NCBO’s BioPortal made hundreds of biomedical ontologies available and searchable beginning in the mid-2000s. EX1003 ¶¶69-71.

B. Knowledge Graphs

A knowledge graph is a structured representation of entities (“nodes”) and their relationships (“edges”) that enables efficient traversal, querying, and reasoning. EX1003 ¶74. In healthcare, knowledge graphs represented medical conditions, findings (e.g., symptoms, signs, and test results), investigations (e.g., tests and procedures), medications, and their relationships. EX1003 ¶¶75-79; EX1006, 6:10-30; EX1011 ¶[0115]; EX1008, FIGS. 1A-1B.



EX1008 FIG. 1A

Practitioners routinely built medical knowledge graphs from multiple evidence sources, including peer-reviewed literature (e.g., The BMJ, JAMA, The Lancet, and NEJM, indexed through resources such as PubMed), clinical guidelines, SNOMED-CT and LOINC, and EHRs. EX1003 ¶¶79-80. Graphs were constructed

manually by subject-matter experts, automatically using NLP and machine learning, or through human-in-the-loop approaches combining the two. EX1003 ¶¶80-82; EX1006, 6:5-30. By 2022, using medical knowledge graphs to integrate clinical evidence, support clinical reasoning, and enable computerized decision support was well known. EX1003 ¶83.

C. Clinical Decision Support Systems

Clinical decision support systems (“CDSS”), in use since the 1970s, are computer-based tools that provide clinicians and other healthcare stakeholders with person-specific, intelligently filtered, and timely information to enhance health-related decisions. EX1003 ¶¶84-85. For example, INTERNIST-I represented conditions and findings separately and used patient characteristics (demographics) to constrain when a condition can occur. *Id.* ¶85. By the priority date, CDSS routinely leveraged structured knowledge bases to support diagnostic reasoning, treatment recommendations, and other clinical decisions. *Id.* ¶86.

D. APIs

An application programming interface (“API”) is a set of protocols, routines, and tools that allow software applications to communicate. EX1003 ¶87. Using APIs to access medical knowledge bases and ontologies was well established before the priority date. *Id.*; EX1007, 100:24-34. For example, BioPortal has provided RESTful APIs since 2006 for searching, browsing, and querying hundreds of biomedical

ontologies; the National Library of Medicine’s Unified Medical Language System (“UMLS”) has long offered API-based terminology services; and HL7’s FHIR standard includes terminology-service APIs. EX1003 ¶¶88. In such systems, an API receives a medical query from an application and returns the output to it. *Id.* ¶¶89.

V. THE ‘882 PATENT

A. AIA Status

The earliest alleged priority date of the ‘882 patent is April 15, 2022. EX1001, (63). The ‘882 patent was examined as an AIA patent. EX1002, 94.

B. Level of Skill in the Art

A person of ordinary skill in the art (“POSITA”) would have had at least a master’s degree in biomedical informatics, computer science, health informatics, or a closely related field and at least two years of experience working with medical knowledge representation systems, biomedical ontologies, knowledge graphs, or clinical decision support systems. EX1003 ¶¶29-32. Additional education can compensate for less professional experience, and vice versa. *Id.*

C. Overview of the ‘882 Patent

The specification frames the purported invention as placing narrative medical evidence “into a structured, computational representation system.” EX1001, 2:45-51; EX1003 ¶¶90-91. But the specification concedes that the claims’ building blocks already existed.

For example, the specification explains that publishers “such as DynaMed, BMJ, UpToDate, etc.” already “assemble the published evidence” into diagnostic content. EX1001, 1:58-2:5. The ‘882 patent uses pre-existing evidence sources, including “BMJ Best Practice (or other British Medical Journal databases),” SNOMED-CT, and LOINC, and its evidence extractor “can extract clinical items from any textual data source.” EX1001, 7:4-21; EX1003 ¶¶92-93. An evidence extractor sends text to an NLP engine, which outputs clinical concepts. EX1001, 7:36-8:9, 12:11-28, FIG. 2.

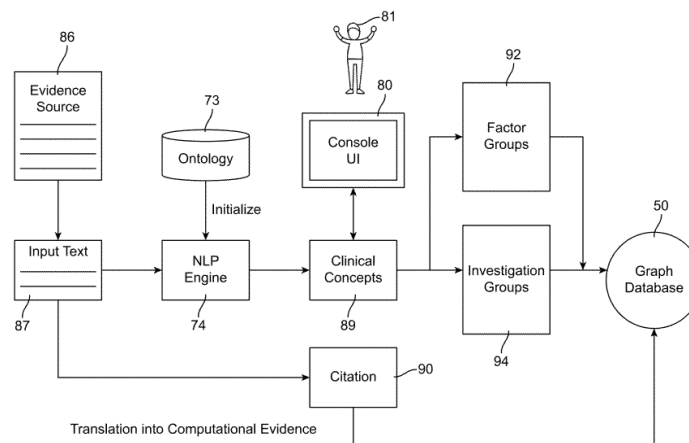


FIG. 2

EX1001, FIG. 2

Extracted concepts are stored as nodes in graph database 50, which is described as a generic, off-the-shelf database: “[a]ny of a wide variety of other types of databases may be used.” EX1001, 8:10-27, 17:60-18:12, FIG. 3; EX1003 ¶96. Diagnostic factors are stored as “elemental diagnostic factors” (“EDFs”) and tests and examinations as “elemental diagnostic investigations” (“EDIs”). EX1001, 9:62-

10:10, 11:65-12:8. An EDF is kept “elemental, independent” – for example, in FIG. 4A, EDF fever 310 links through factor groups 304 and 344 to conditions 300 and 340. *Id.*, 10:53-62, 11:16-35, 18:31-67, 19:38-20:3, FIG. 4A.

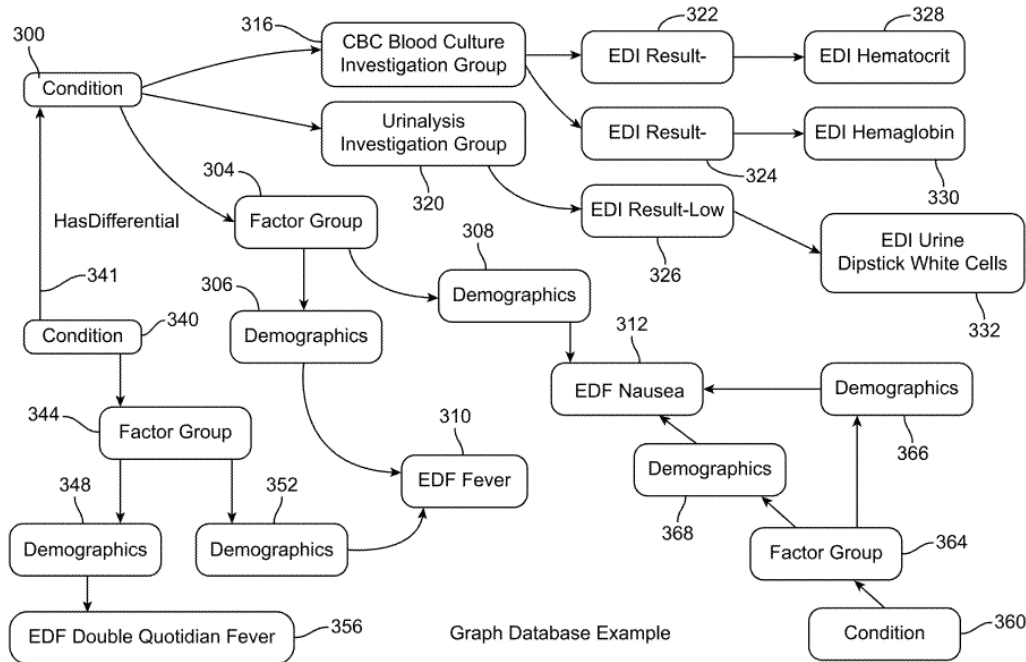
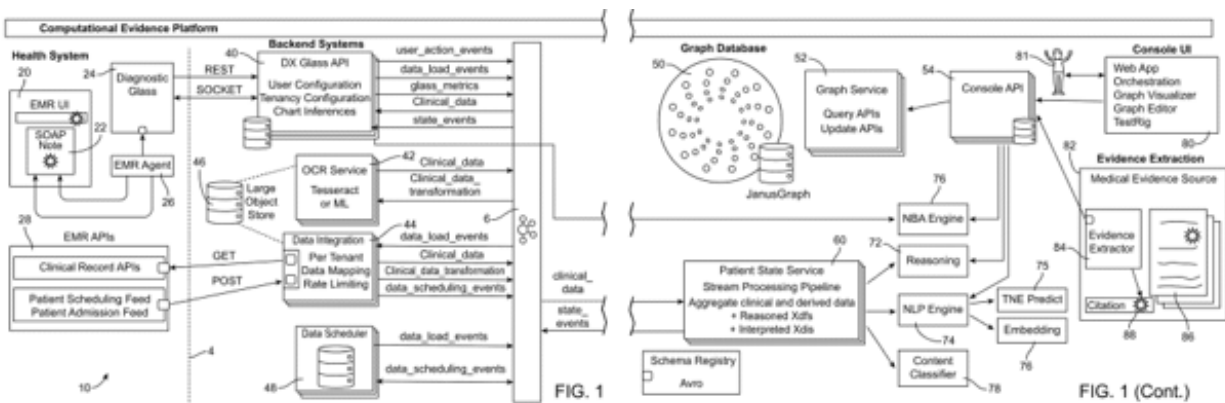


FIG. 4A

EX1001, FIG. 4A

Each EDF node holds its name, synonyms, temporality, negation, and experiencer attributes, and an identifier linking to a taxonomy whose hierarchy the system can traverse. EX1001, 20:28-40, 21:14-49, FIG. 4B. The “taxonomies” and “hierarchies” come from pre-existing ontologies, including SNOMED-CT, where “one taxonomy provides a hierarchy of diagnostic factors and another taxonomy provides a hierarchy of conditions.” EX1001, 4:13-22. The system uses SNOMED-CT, LOINC, and RxNorm as they exist. *Id.*, 5:13-19, 8:48-54; EX1003 ¶95.

The platform matches diagnostic factors and investigation results from a patient's chart to EDF and EDI nodes and ranks likely conditions. EX1001, 22:44-25:67, FIG. 5. A next-best-action ("NBA") engine identifies, for each likely condition, unknown factors and tests not yet performed. EX1001, 26:1-27:44, FIG. 6. The only APIs described are existing standards, such as "FHIR, USCDI (United States Core Data for Interoperability), CDS Hooks, and vendor-specific APIs," and FIG. 1 shows "Query APIs" and "Update APIs" only as generic boxes. EX1001, 6:4-8, FIG. 1; EX1003 ¶97.



EX1001 FIG. 1 (combined)

D. Prosecution History

The application leading to the '882 patent was filed February 4, 2025, with a Track One request. EX1002, 141-42, 146-47. The Examiner rejected all original claims under § 101 as reciting steps that "can be practically performed by a human, either mentally or with the use of pen and paper," plus "insignificant extra-solution activity," and rejected claims 1-7, 10, and 16-29 under § 102. *Id.*, 92-103, 107-19.

To overcome § 101, the applicant amended the independent claims to recite “establish one or more application programming interfaces (APIs) for said graph database” allowing an application to access the linked entries “in order to generate a healthcare determination,” arguing that “an API [is] a software construct that a human cannot practically perform in his or her mind” and that the claims recite “a specific data architecture (similar to the Enfish case).” EX1002, 57-76. For § 102, the applicant argued that Iliff stores patient-record concepts in the EMR rather than a knowledge graph and lacks a diagnostic-factor entry without condition-specific information. *Id.*, 69-72. The Examiner allowed the claims based on the recited data arrangement combined with the API limitation. *Id.*, 11-21.

The Examiner never applied any reference relied on here in a rejection. EX1002, 107-18. Datla and Goldberg are cited on the face of the ’882 patent but were never applied; Gnanasambandam, Dang, Zhong, Van Assel, Kim, and MacRae were not cited or considered. EX1001, (56).

VI. CLAIM CONSTRUCTION

Claims are given their plain and ordinary meaning as understood by a person of skill in the art. 37 C.F.R. § 42.200(b). Petitioner is unaware of any prior claim construction determination related to the ’882 patent. Because the challenged claims are unpatentable under any interpretation consistent with their plain and ordinary meaning, the Board need not expressly construe any claim term.

VII. OVERVIEW OF THE APPLIED PRIOR ART

Each of Datla, Goldberg, Gnanasambandam, Dang, Zhong, Van Assel, and Kim is analogous art because it is in the '882 patent's field of endeavor – systems and methods for automating access to medical data. EX1001, 1:24-28; EX1005 ¶[0001]; EX1006, 1:17-20; EX1007, 1:17-31; EX1008 ¶[0001]; EX1009, 1:6-10; EX1011 ¶¶[0001], [0115]; EX1012 ¶¶[0015]-[0016], [0038]-[0039].

A. Datla

Datla published August 15, 2019 from an application filed April 15, 2019, with an international filing date of October 24, 2017. EX1005, codes (22), (43), (86). Datla is prior art at least under 35 U.S.C. § 102(a)(1).

B. Goldberg

Goldberg issued April 25, 2023 from an application filed August 12, 2019. EX1006, codes (22), (45). Goldberg is prior art at least under 35 U.S.C. § 102(a)(2).

C. Gnanasambandam

Gnanasambandam issued March 11, 2025 from a national-phase application filed April 29, 2022, with an international filing date of October 30, 2020. EX1007, codes (22), (45), (86). Gnanasambandam is prior art at least under 35 U.S.C. § 102(a)(2). *See* 35 U.S.C. § 363.

D. Dang

Dang published June 30, 2022 from an application filed December 31, 2020. EX1008, codes (22), (43). Dang is prior art at least under 35 U.S.C. § 102(a)(2).

E. Zhong

Zhong issued December 7, 2021 from an application filed July 11, 2016 and published January 11, 2018. EX1009, codes (22), (45), (65). Zhong is prior art at least under 35 U.S.C. § 102(a)(1).

F. Van Assel

Van Assel published July 29, 2021 from an application filed January 23, 2020. EX1011, codes (22), (43). Van Assel is prior art at least under 35 U.S.C. § 102(a)(1).

G. Kim

Kim published July 4, 2024 from a national-phase application filed January 17, 2024, with an international filing date of July 21, 2021. EX1012, codes (22), (43), (86). Kim is prior art at least under 35 U.S.C. § 102(a)(2). *See* 35 U.S.C. § 363. Kim is also reasonably pertinent to a problem the '882 patent addresses: recognizing the same clinical concept across sources that use different terms. EX1012 ¶¶[0050]-[0051]; EX1001, 10:11-17, 10:67-11:3.

H. MacRae

MacRae is an article in the open-access journal BMJ Open, first published online August 21, 2015. EX1013, 1; EX1046; EX1047; EX1045 ¶¶3-7; EX1049. BMJ Open download statistics show it was accessed hundreds of times before 2022. EX1046; EX1048, 1-2; EX1045 ¶8. MacRae is prior art at least under 35 U.S.C. § 102(a)(1). Patent Owner relies on MacRae in its infringement allegations as a

“medical evidence journal” that “provides different taxonomies” under claims 21 and 32. EX1019, 88-93, 125-130; EX1003 ¶¶385.

VIII. UNPATENTABILITY GROUNDS

A. Ground 1: Claims 1-3, 8-9, and 11-14 are Unpatentable Over Datla, Goldberg, and Gnanasambandam

Claims 1-3, 8-9, and 11-14 would have been obvious over Datla, Goldberg, and Gnanasambandam. EX1003 ¶¶120-227. In the combination, Datla supplies the medical-evidence corpus, clinical concepts, graph structure, and diagnostic outputs; Goldberg supplies the ontology-based taxonomies and hybrid clinical knowledge graph; and Gnanasambandam supplies API-based access. *Id.* ¶¶120-126.

1. Motivation to Combine

A POSITA would have combined Datla and Goldberg because both address computer-implemented clinical diagnosis using knowledge graphs and supply complementary teachings. Datla builds a graph from a broad medical corpus and uses weighted symptom-condition relationships to rank diagnoses. EX1005 ¶¶[0030]-[0036]; EX1003 ¶¶121-122. Datla’s system “may” map topical keywords extracted from patient “descriptions, summaries or notes” to “categories represented in” controlled clinical ontologies, including “SNOMED CT for diagnoses, LOINC for tests, and/or RxNorm for treatments.” EX1005 ¶[0054]. A POSITA would recognize that constructing the graph from those ontologies would be beneficial

because using standardized terms from ontologies improves the reliability of a query.

EX1003 ¶122.

Goldberg discloses a knowledge graph that combines literature-derived clinical relationships with ontology-based graphs, including SNOMED and LOINC, whose standardized concepts and hierarchies improve coverage and consistency. EX1006, 5:51-62, 6:10-34; EX1003 ¶¶121-124. A POSITA would have been motivated to modify Datla to include information from ontologies in the knowledge graph, as Goldberg teaches, as it would improve the completeness and usability of Datla's knowledge graph. EX1003 ¶¶123-124. Indeed, Datla discloses that the sources used to build its knowledge graph can be "any source of information." EX1005 ¶[0030]; EX1003 ¶122. A POSITA would have had a reasonable expectation of success because the combination applies a known technique to a known system to yield a predictable knowledge graph constructed from medical evidence sources that provide different taxonomies. EX1003 ¶124.

Gnanasambandam supplies a conventional software interface with APIs that use artificial intelligence to perform analytics based on a medical knowledge graph, and it provides those APIs to client applications. EX1007, 51:27-42, 55:50-58, 100:24-47. Publishing APIs would make Datla's knowledge graph accessible to external applications in the deployment pattern taught by Gnanasambandam. EX1007, 100:24-34, 102:22-46. Adding an API layer to Datla's knowledge graph-

based system involves applying a known technique (Gnanasambandam's API) to a known system (Datla's knowledge graph) to yield the predictable result of an API-accessible system that generates healthcare determinations in response to queries. EX1003 ¶126. A POSITA would have had a reasonable expectation of success because APIs for knowledge-based systems were already well known, and no technical barrier would have impeded the combination. *Id.*; *supra* §IV.D.

2. Independent Claim 1

Each limitation of claim 1 is disclosed or rendered obvious by the combination. EX1003 ¶¶127-186.

a. Element [1pre]

To the extent the preamble is limiting, Datla discloses a computer system for integrating medical evidence text into a computational form. Datla provides “automated methods and systems to provide a clinical diagnosis of a patient's symptoms based on a corpus of medical knowledge.” EX1005 ¶[0001]; EX1003 ¶129. Datla integrates medical evidence text into a computational form: a knowledge graph with nodes and weighted edges representing clinical concepts and their relationships. EX1005 ¶¶[0030]-[0032]; EX1003 ¶129.

b. Element [1a]

Datla discloses system 500 with processor 530 and memory 540. EX1005 ¶[0079]; EX1003 ¶131.

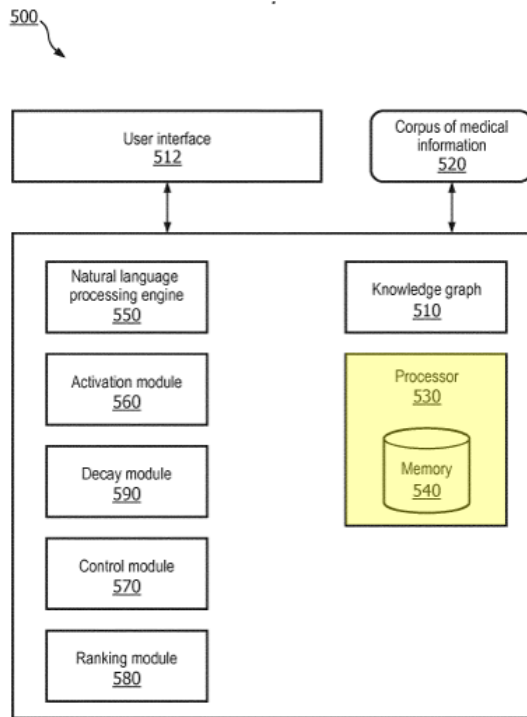


FIG. 5

EX1005 FIG. 5 (annotated)

The processor performs diagnostic operations, while the memory stores the operating system and other program instructions. EX1005 ¶¶[0078]-[0081]; EX1003 ¶¶130-132. In the combination, the memory stores instructions that perform the functions in elements [1b]-[1h] and the dependent claims. EX1003 ¶133.

c. Element [1b]

Datla's system receives text pertaining to a plurality of medical conditions from a "corpus of medical information" that "can be any source of information, including but not limited to *medical journals*, newspapers, online sources such as Wikipedia, and other sources." EX1005 ¶[0030] (emphasis added); *see also id.*

¶[0078], FIG. 3; EX1003 ¶135. For example, Datla receives articles covering a wide range of conditions. EX1005 ¶[0040]; EX1003 ¶135. Datla builds its graph using “topical keyword analysis in which the most clinically relevant keywords from the given topic descriptions, summaries, and clinical notes are identified” EX1005 ¶[0034]. Datla thus receives and processes the electronic text of medical evidence sources, including published journals, and its graph links symptoms “to hundreds of other nodes,” reflecting the breadth of conditions covered. EX1005 ¶¶[0030]-[0034]; EX1003 ¶136.

Datla’s construction of the knowledge graph is shown as step 112 in FIG. 1. EX1005 ¶¶[0030]-[0034], FIG. 1; EX1003 ¶137.

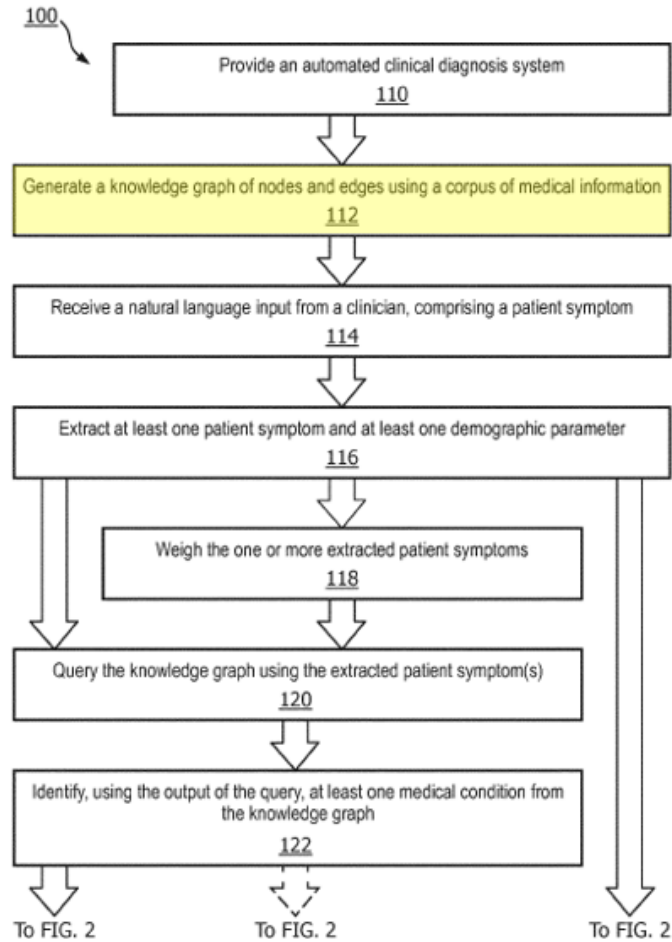


FIG. 1

EX1005 FIG. 1 (annotated)

FIG. 3 shows a knowledge graph 310. EX1005 ¶[0031], FIG. 3; EX1003 ¶138.

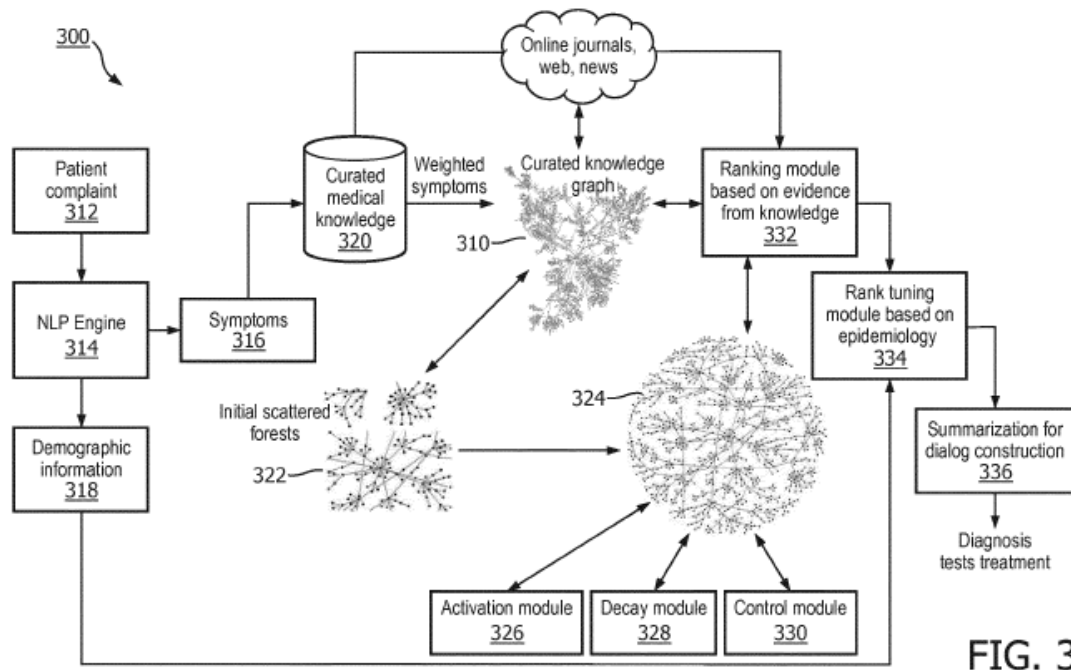


FIG. 3

EX1005 FIG. 3

Datla expressly identifies “medical journals” (i.e., published journals) as a source category. EX1005 ¶¶[0030], [0038]; EX1003 ¶139. Datla also processes medical journal articles from over 1.25M PubMed Central articles, which Datla describes as a “freely available online database of full-text biomedical articles.” EX1005 ¶¶[0047]-[0048]; EX1003 ¶139.

d. Element [1c]

Datla retrieves diagnostic factors associated with medical conditions when it processes medical evidence source text to extract symptoms, signs, diagnoses, tests, and treatments, each associated with one or more medical conditions. EX1005 ¶¶[0034]-[0036]; EX1003 ¶141. Datla gives an example where the source is a Wiki page:

The first section of such a Wiki page normally contains an introduction to the diagnosis. Among several other sections inside the Wiki page, the ‘Signs and symptoms’ section describes the classic and common signs and symptoms for the diagnosis. Each collected Wikipedia page is turned into a key-value pair by using the following principle: the free text from the first section and the sections for sign and symptoms is the key and the title of the page is the value.

EX1005 ¶[0040]; EX1003 ¶142. In this example, the page title (a medical condition) is the value; the extracted signs and symptoms (diagnostic factors) are the keys. Datla uses this to “generate the diagnoses, tests, and treatments using the underlying clinical contexts.” EX1005 ¶[0034]; EX1003 ¶142. A POSITA would understand that the same process would be employed for the other sources of information, including medical journals. EX1005 ¶[0030]; EX1003 ¶143.

e. Element [1d]

Element [1d] requires that the medical evidence sources collectively provide different taxonomies arranging diagnostic factors and medical conditions in different hierarchies. EX1003 ¶145. The specification ties those taxonomies to ontologies such as SNOMED-CT, with one taxonomy providing a hierarchy of diagnostic factors and another a hierarchy of conditions. EX1001, 4:17-27, 20:33-34; EX1003

¶¶145-146. Datla alone discloses or renders obvious this limitation; alternatively, it would have been obvious in view of Goldberg.

Datla discloses sources organized hierarchically: “when utilizing an online source *with a hierarchy* and a master top category (such as ‘clinical medicine’), all pages including and under the master top category are analyzed and the *hierarchy* of the sub-categorized pages is maintained, with information being extracted from each page.” EX1005 ¶[0030]. Datla preserves those relationships in the graph by “adding a first node representing a first clinical concept, a second node representing a second clinical concept, and an edge between the first node and the second node *according to a hierarchical relation* of the corpus of medical information.” EX1005, claim 16; *see also* ¶[0035] (“The hierarchy of each Wiki page is preserved to encode its distinguishing characteristics with respect to other pages.”); EX1003 ¶¶147-150. A clinical-medicine hierarchy can place medical conditions in one branch and signs and symptoms, which are diagnostic factors, in another. Those separate branches are different taxonomies arranging the two categories in different hierarchies. EX1003 ¶151.

Datla also contemplates multiple differently organized sources. For example, FIG. 4 identifies a “curated knowledge source” including “Wikipedia, medical textbooks, biomedical literature,” and Datla recognizes that information from one source may relate to other sources or medical conditions. EX1005 ¶[0030], FIG. 4;

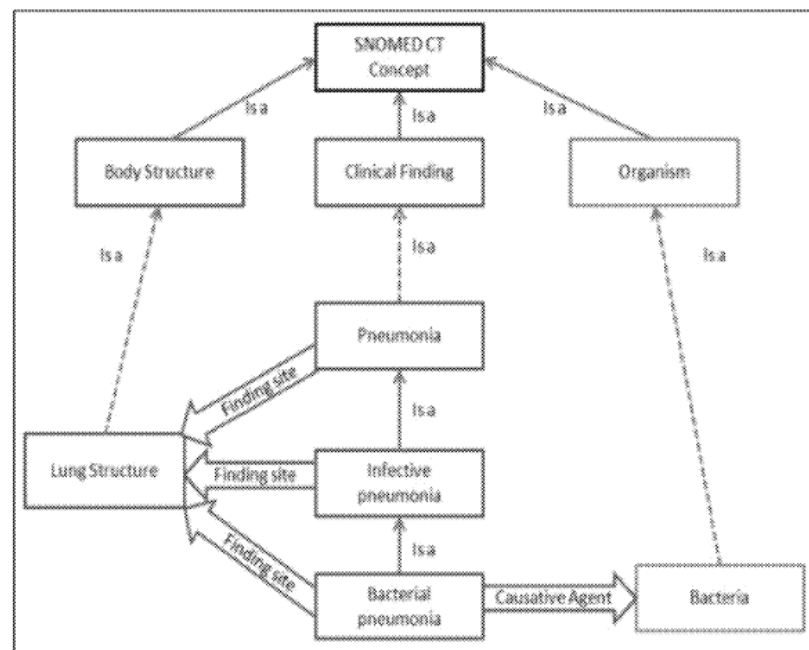
EX1003 ¶152. A POSITA would therefore have understood that the corpus could provide different taxonomies, or at least would have found it obvious to construct the graph from such sources. Further, it would have been obvious to include SNOMED CT, LOINC, and RxNorm in Datla's "any source of information" corpus to ensure that the ontology categories referenced in Datla are represented in the graph built from that corpus. Datla's system "may" map topical keywords to "categories represented in" controlled clinical ontologies, including "SNOMED CT for diagnoses, LOINC for tests, and/or RxNorm for treatments." EX1005 ¶¶[0030], [0054]; EX1003 ¶¶153-154. This would provide corresponding graph entries for those ontology categories without changing Datla's hierarchy-preserving graph construction.

To the extent Patent Owner argues that Datla alone does not disclose or render obvious element [1d], it would have been obvious in view of Goldberg, which describes translating medical knowledge from "multiple sources (e.g., books, articles, publications, personal knowledge etc.)" into a hybrid knowledge graph integrating clinical knowledge with ontology-based graphs such as SNOMED and LOINC. EX1006, 5:51-62. Goldberg further describes a first graph derived from a healthcare ontology such as SNOMED, a second graph derived from an ontology dedicated to laboratory tests and procedures such as LOINC, and a third graph

created from medical publications to capture clinical statistical relationships. EX1006, 6:10-24; EX1003 ¶¶155-157.

Goldberg confirms that SNOMED covers hundreds of thousands of medical terms arranged as an ontology, including findings and disorders grouped in families, and FIG. 6 shows a SNOMED concept tree in knowledge-graph format. EX1006, 1:44-2:1, 9:50-52, FIG. 6.

FIG. 6



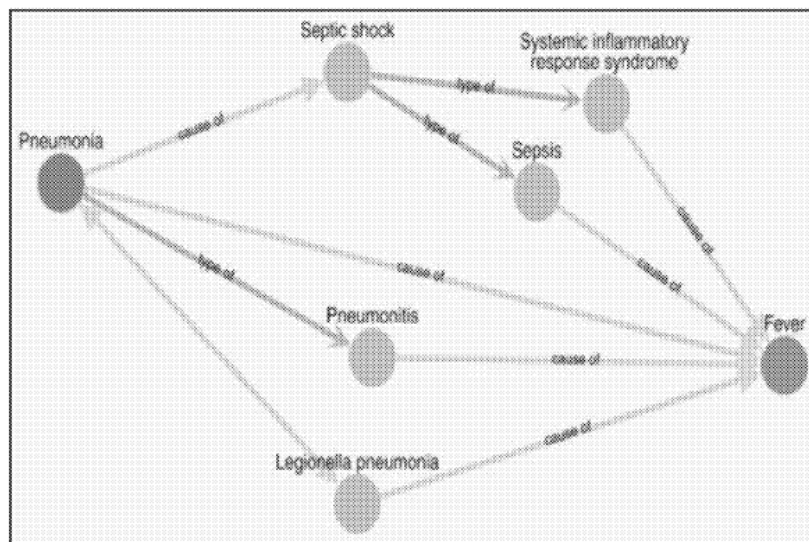
EX1006 FIG. 6

Goldberg carries hierarchical relations into the graph: darker arrows represent SNOMED type-of relations, lighter arrows represent clinical relations from medical literature, and the model may account for ontology subtype relations. EX1006, 10:4-

23, 10:41-46; EX1003 ¶¶158-160. The combined sources thus provide different taxonomies and hierarchies.

FIG. 9 illustrates clinical relations connecting Pneumonia and Fever, with darker arrows for SNOMED “type-of” relations and lighter arrows for clinical relations taken from medical literature. EX1006, 10:4-12.

FIG. 9



EX1006 FIG. 9

A POSITA would have been motivated to include ontology sources in Datla’s corpus for at least three reasons. First, the ontology categories referenced in Datla’s statement that its system “may” map topical keywords to “categories represented in” controlled clinical ontologies would correspond to entries in the knowledge graph. EX1005 ¶¶[0030], [0054]-[0055]. Second, Goldberg explains that ontologies capture health terms and semantic relations but not clinical relations, so integrating

ontology sources with literature-derived clinical knowledge would improve healthcare by supplying both standardized concepts and the relations described in medical literature. EX1006, 1:54-2:6, 2:24-30; EX1003 ¶¶161-164; *see also* EX1010, 11:18-19 (confirming that ontologies facilitate extracting and combining concepts from biomedical literature and provide disease-hierarchy information). Third, SNOMED’s hundreds of thousands of medical terms would improve coverage. EX1006, 1:54-56; EX1003 ¶165.

A POSITA would also have reasonably expected success. Datla’s corpus “can be any source of information,” and Datla already recites adding graph edges “according to a hierarchical relation of the corpus of medical information.” EX1005 ¶[0030], claim 16. Goldberg demonstrates that deriving graph content from SNOMED and LOINC and linking it with literature-derived clinical relations was known. EX1006, 10:4-23. The combination thus applies known ontology and graph-construction techniques to Datla’s known medical knowledge graph with predictable results. EX1003 ¶166.

Datla also discloses the second clause of element [1d]. For example, Datla’s Wiki example extracts signs and symptoms indicative of the titled diagnosis. EX1005 ¶[0040]; EX1003 ¶¶142-143. Datla weights edges by “the frequency with which the two nodes are associated within a source or a corpus, or that the two nodes appear within the same source such as an online database or within the same medical

journal.” EX1005 ¶[0032]. Thus, for example, fever is discussed as a symptom of multiple conditions and is treated as indicative of those conditions. EX1005 ¶[0031]; EX1003 ¶381.

f. Element [1e]

Datla’s knowledge graph cross-links diagnostic factors and medical conditions through weighted edges. EX1005 ¶[0031] (“[T]he knowledge graph 310 is a tree-like structure with a plurality of nodes connected by one or more edges. Each root node of the graph is a symptom, and the remaining nodes are conditions, diagnoses, tests, procedures, medications, or other clinical concepts. An edge is a relationship between two nodes.”); EX1003 ¶168. The same symptom node links to multiple condition nodes through weighted edges. EX1005 ¶[0031] (“[A] symptom of a fever will be connected by edges to hundreds of other nodes, as a fever is a symptom of many patient scenarios.”); EX1003 ¶168. As discussed for element [1d], these diagnostic factors and medical conditions are arranged in different hierarchies in the medical evidence sources. EX1003 ¶¶167-169.

Datla further discloses that its knowledge graph 510 is stored in a database. EX1005 ¶[0078] (“a system 500 for automated clinical diagnosis” that “can comprise any of the elements, engines, database, processors, and/or other components described or otherwise envisioned herein”). Datla discloses, and a POSITA would understand, that creating the knowledge graph within system 500

would involve creating a graph database to store the knowledge base. EX1005 ¶[0078]; EX1003 ¶169.

g. Element [1f]

In Datla's knowledge graph, each diagnostic factor and each medical condition is stored as its own separate node, with edges representing the cross-links between them. EX1005 ¶[0031] ("Each root node of the graph is a symptom, and the remaining nodes are conditions, diagnoses, tests, procedures, medications, or other clinical concepts. An edge is a relationship between two nodes."); EX1003 ¶171. Each symptom node is a separate entry, each condition node is a separate entry, and the weighted edges between them constitute cross-linking. EX1003 ¶171.

A first entry (e.g., a symptom node for fever, a diagnostic factor indicative of a first medical condition) is linked through an edge to a second entry (a condition node for that condition); the fever node links to the condition nodes for each condition of which fever is a symptom. EX1005 ¶[0031] ("[A] symptom of a fever will be connected by edges to hundreds of other nodes, as a fever is a symptom of many patient scenarios."); EX1003 ¶172.

h. Element [1g]

Each Datla diagnostic factor node is condition-independent: condition-specific relationship information resides on the edges, not in the node, and the same

symptom node links to multiple conditions through different weighted edges.

EX1005 ¶¶[0031]-[0032]; EX1003 ¶174.¹

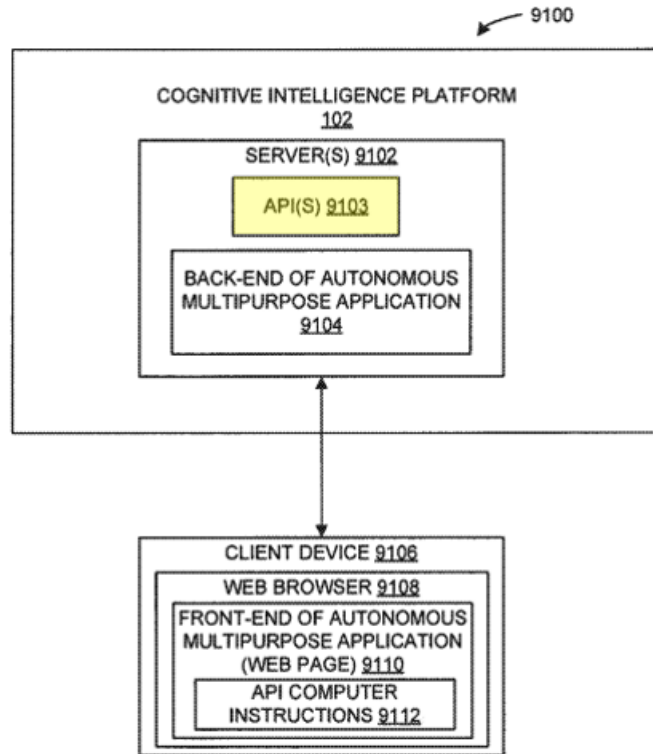
The claimed negative limitation is a routine design principle in modern knowledge graphs that removes unnecessary dependencies between entries to facilitate flexibility and the ability to perform inferences. EX1003 ¶175. To the extent it is not expressly disclosed or understood from Datla (which it is), such a design would have been obvious to a POSITA. *Id.*

i. Element [1h]

Using APIs to access knowledge graphs was well known prior to the ‘882 patent. *Supra* §IV.D. In the combination, Gnanasambandam supplies this element.

Gnanasambandam discloses publishing APIs for a medical knowledge graph, including an “[a]pplication back-end component 9104 [that] is configured to publish one or more APIs 9103,” which “may use artificial intelligence to perform analytics based on a knowledge graph pertaining to ontological data of a medical condition.” EX1007, 100:24-34, FIG. 91; EX1003 ¶178.

¹ According to Patent Owner’s infringement allegations, the fact that a single diagnostic factor node is linked to the same medical condition node in a knowledge graph means that the nodes are condition-independent. EX1017, 17-19.



EX1007 FIG. 91 (annotated)

Gnanasambandam discloses providing the APIs in a user interface. For example, “in FIG. 92, at step 9204, method 9200 continues with providing the at least one API in a user interface of a computing device.” EX1007, 102:22-24; EX1003 ¶179.

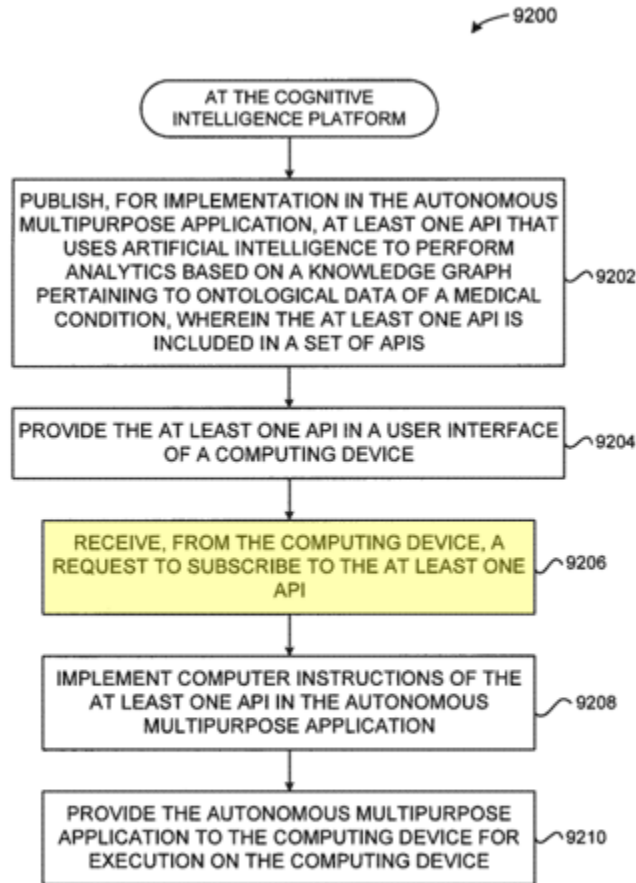


FIG. 92

EX1007 FIG. 92 (annotated)

As discussed above, Datla discloses generating a healthcare determination by querying the knowledge graph using extracted patient symptoms, traversing edges to connected condition nodes, and generating ranked diagnoses as the healthcare determination. EX1005 ¶¶[0055]-[0062]; EX1003 ¶180. Datla explains that “the ranked medical conditions and/or diagnosis are provided to the clinician” and that “[t]he medical conditions and/or diagnosis can be provided to the user via any user interface that allows information to be conveyed, such as a speaker or screen, among

many other types of user interfaces.” EX1005 ¶[0062]; EX1003 ¶180. Gnanasambandam’s APIs provide an interface mechanism through which an external application accesses the knowledge graph to generate those determinations. EX1007, 100:24-34; EX1003 ¶181. In the combined system, Gnanasambandam’s published APIs serve as the interface through which an application, such as that running on Datla’s interface 512 (*see* EX1005 ¶[0080]; EX1007, 100:22-24; EX1003 ¶184), integrates with Datla’s knowledge graph to access linked entries and generate healthcare determinations. *Id.*

A POSITA would have been motivated to combine Datla and Gnanasambandam for at least three reasons. First, Gnanasambandam, like Datla, operates in the field of medical knowledge graph-based decision support, and a POSITA building a medical knowledge graph system would naturally look to Gnanasambandam for techniques to deploy that system as a service. EX1007, 51:27-34, 55:50-58, 100:24-28; EX1003 ¶183. Second, publishing APIs for a knowledge graph-based system is the standard way to make such a system accessible to external applications (e.g., clinical decision support tools or electronic health record systems), and Gnanasambandam teaches this deployment pattern. EX1007, 100:24-34, 102:22-24; EX1003 ¶184. Third, Datla is designed for external integration and is naturally suited for API-based access. EX1005 ¶[0028]; EX1003 ¶185. Wrapping Datla’s diagnostic inference functionality in Gnanasambandam’s API layer would

allow any healthcare application to query the knowledge graph and receive diagnostic determinations. EX1003 ¶185. This modification involves applying a known technique (API publication, as taught by Gnanasambandam) to a known system (Datla's knowledge graph) to yield the predictable result of an API-accessible medical knowledge graph system that generates healthcare determinations in response to application queries. EX1003 ¶186.

3. Claim 2

Datla's processor queries the knowledge graph "to generate a diagnosis graph as a subset of the knowledge graph" and identifies "a ranked list of one or more medical conditions" from it. EX1005 ¶[0007], claim 1. The diagnosis graph, "a connected digraph that represents the connected symptoms," is built by expanding from symptom nodes to connected condition nodes and includes a condition node, its linked diagnostic-factor nodes, and the edges between them. *Id.* ¶¶[0006], [0055]-[0057]; EX1003 ¶188. Datla provides "medical conditions and/or diagnosis" to the user "via any user interface that allows information to be conveyed, such as a speaker or screen," but does not expressly state that the graph itself is displayed. EX1005 ¶[0062]; EX1003 ¶188.

Goldberg teaches "transmitting ... a medical knowledge graph to a user, the medical knowledge graph depicting a plurality of nodes and a plurality of connectors between the plurality of nodes." EX1006, 14:32-42. Its interface can show "any

depth of associations,” including a disease’s direct and indirect findings and “all or a selected level of associations,” and the Pneumonia example shows “all associations with findings, lab tests, etc.” EX1006, 5:5-10, 8:63-67, 9:24-29, 11:61-63, 12:6-11, FIGS. 9-10; EX1003 ¶¶189-191.

It would have been obvious to display Datla’s graph for three reasons. First, Datla seeks to provide diagnoses and treatments “in addition to the rationale for each option,” and Goldberg can show a “path to decision,” the clinical reasoning path behind a diagnosis or next step. EX1005 ¶[0003]; EX1006, 8:40-46. Second, Datla already generates the relevant subset, so displaying it requires no change to graph construction or traversal. EX1005 ¶¶[0007], [0056]. Third, showing the condition, linked findings, and links lets a clinician verify the suggested diagnosis, including by accessing original citations. EX1006, 11:61-67; EX1003 ¶192. In the combination, an application accesses the graph through Gnanasambandam’s APIs and displays that portion on a computing device. *Supra* §VIII.A.2.i; EX1007, 100:24-34; EX1003 ¶193.

4. Claim 3

Datla’s graph is one in which “each node is a medical condition, diagnosis, test, procedure, medication or any other clinical concept, and each edge is a relation between two nodes,” and Datla’s claim 1 recites a knowledge graph comprising a plurality of nodes, including patient-symptom nodes. EX1005 ¶¶[0031], [0035],

claim 1. As explained for element [1f], each diagnostic factor and medical condition is a separate entry, and each such entry is a node. *Supra* §VIII.A.2.g; EX1003 ¶¶194-195.

5. Claim 8

Datla's graph "possesses symptoms as root nodes connected by edges to the diseases and medical conditions associated with those symptoms." EX1005 ¶¶[0036], [0006]. "[A] symptom of a fever will be connected by edges to hundreds of other nodes, as a fever is a symptom of many patient scenarios," whereas nystagmus "will have few nodes as it is a symptom of fewer patient scenarios," confirming that the number of connected nodes reflects the conditions associated with the factor. EX1005 ¶[0031]; EX1003 ¶¶196-198. The single fever node is therefore a diagnostic factor for a first and a second medical condition, both linked to it. EX1003 ¶¶196-198.

6. Claim 9

Claim 9 does not require that the rank be stored in a particular structure, only that traversal from a shared diagnostic factor to two different conditions produce two different ranks. EX1003 ¶200. The specification states that rank may be expressed

numerically or in words referring to the likelihood that a group of factors is caused by a particular condition. EX1001, 11:46-49, 17:30-35, 19:66-20:4; EX1003 ¶200.

Datla's fever node "will be connected by edges to hundreds of other nodes," and Datla weights edges based on the relationship between connected nodes, including "the frequency with which the two nodes are associated within a source or a corpus"; "[t]he weight may be variable and based on the strength of the relationship." EX1005 ¶¶[0010], [0031]-[0032]. Because fever does not appear with the same frequency across conditions in the medical literature, a POSITA would understand that at least some edges from fever to different conditions carry different weights, each reflecting the strength of fever's association with the linked condition and thus a rank for fever in that condition's context. EX1003 ¶201.

Goldberg confirms this: its knowledge base "holds a probabilistic association between various disease and disorder features," translating medical text into associations "indicating the probability which links each feature with the disease," and its CROHN's/CELIAC example lists diseases with likelihoods given particular features. EX1006, 4:56-63, 5:66-6:7, 9:1-23, FIGS. 4-5. Goldberg's diagnostic application "takes into consideration the strength of the various associations as indicated in the knowledge base." *Id.*, 7:30-36. It would have been obvious to apply Datla's edge weights during activation propagation because doing so would

predictably improve diagnostic accuracy while leaving Datla's graph structure unchanged. EX1003 ¶¶202-204.

7. Claim 11

Datla treats tests as separate clinical-concept entries linked to conditions: its graph includes “conditions, diagnoses, tests, procedures, medications, or other clinical concepts,” with edges representing relationships between nodes. EX1005 ¶¶[0031], [0035]. A POSITA would understand these tests to include laboratory tests, which are common in the clinical-medicine sources from which Datla builds its graph, and Datla extracts “lab results” from clinical input. EX1005 ¶¶[0006], [0030], [0052]; EX1003 ¶¶206-207. Datla's system “may” map topical keywords to “categories represented in” ontologies including “LOINC for tests.” EX1005 ¶[0054]; EX1003 ¶¶206-207.

Datla retrieves tests associated with conditions from its corpus of medical journals, online sources, and other medical information, using possible diagnoses to extract candidate articles and “corresponding treatment and test information ... from the curated corpus.” EX1005 ¶¶[0030], [0037], [0073]. Datla links test nodes to condition nodes and may recommend “a test to distinguish between two possible diagnoses.” *Id.* ¶¶[0007], [0063]. The relationship information is carried by the edge, not the test node, because Datla weights edges based on the relationship between nodes. *Id.* ¶[0032]; *supra* §VIII.A.2.h. A test that distinguishes between two

diagnoses need not include information specific to either condition. EX1005 ¶[0063]; EX1003 ¶¶208-210.

Alternatively, Goldberg supplies the same architecture, deriving a second graph from “an ontology dedicated to laboratory tests and procedures (e.g., LOINC)” and linking concepts across ontology graphs. EX1006, 6:17-24. A POSITA would have been motivated to represent Datla’s laboratory tests the same way, preserving reusable test entries and keeping condition-specific relationships in the links, and would have reasonably expected success because Goldberg demonstrates the combined architecture. EX1003 ¶¶211-212.

8. Claim 12

Each node in the combined graph is an entry. *Supra* §VIII.A.4; EX1003 ¶214. Datla’s corpus can include all pages under a “clinical medicine” master category; its graph includes conditions, diagnoses, tests, procedures, medications, and other clinical concepts; a symptom like fever may connect to “hundreds of other nodes”; and the graph may be updated with “new journal articles, new online sources, or other possible sources of new information.” EX1005 ¶¶[0030]-[0032], [0035]. A POSITA would have understood and found obvious that a graph covering clinical medicine and continuously expanded would contain more than twenty thousand entries. EX1003 ¶214.

Goldberg confirms the obviousness of the claimed scale, describing graphs derived from SNOMED and LOINC and a clinical probability graph created from medical publications. EX1006, 6:10-34. Because SNOMED covers “hundreds of thousands of medical terms arranged as an ontology,” the SNOMED-derived graph alone exceeds twenty thousand entries. EX1006, 1:54-2:1; EX1003 ¶215.

Scaling the graph beyond twenty thousand nodes would have been obvious as a routine duplication of parts. *Precision Power, LLC v. Powertec Solutions Int’l, LLC*, PGR2021-00043, Paper 12 at 23 n.12 (PTAB Aug. 3, 2021) (quoting *In re Marcum*, 47 F.2d 377, 378 (CCPA 1931)) (“It is well-settled that ‘[a] mere duplication of parts is not invention.’”); see also *In re Harza*, 274 F.2d 669, 671 (CCPA 1960) (“the mere duplication of parts has no patentable significance unless a new and unexpected result is produced.”). Datla contemplates graph growth, and Goldberg’s knowledge base may be continuously updated given “[t]he amount of available medical knowledge and its growth rate.” EX1005 ¶[0032]; EX1006, 7:51-56; EX1003 ¶216. Adding more conditions with associated findings and investigations using the same node types produces no new or unexpected result. EX1005 ¶[0053], [0055]-[0059]; EX1003 ¶217. The ’882 patent attaches no significance to the threshold, stating that “an actual graph database will be much more complex and contain many hundreds of thousands of nodes or more.” EX1001, 27:67-28:3; EX1003 ¶218.

9. Claim 13

Claim 13 differs from claim 12 only in its one-hundred-thousand-entry threshold. A POSITA would have understood or found obvious that Datla's graph would exceed that threshold for the same reasons. *Supra* §VIII.A.8; EX1003 ¶¶219-221. To the extent required, the same routine-scaling analysis applies: adding further conditions, diagnostic factors, tests, and other clinical concepts duplicates disclosed components with no unexpected result, and the '882 patent attaches no technical significance to the threshold. *Precision*, Paper 12 at 23 n.12; *Harza*, 274 F.2d at 671; EX1005 ¶¶[0030]-[0032]; EX1001, 27:67-28:3; EX1003 ¶222.

10. Claim 14

Any one of a recommendation, evaluation, result, or conclusion satisfies claim 14, and Datla's output satisfies each. Datla identifies "a ranked list of one or more medical conditions, diagnoses, treatments, and/or tests for the patient from the diagnosis graph" and provides those outputs through its interface. EX1005 ¶¶[0007], [0062]. The ranked list is a result of querying the graph, an evaluation of the patient's likely conditions, and a conclusion as to the most probable diagnosis. EX1005 ¶¶[0011], [0057]; EX1003 ¶¶224-225. Datla's system also "provides one or more possible diagnoses, tests, and/or treatments," can "recommend the diagnosis," and "may recommend a test to distinguish between two possible diagnoses"—

recommendations presented to the clinician. EX1005 ¶¶[0028], [0061], [0063]; EX1003 ¶226.

In the combined system, an application uses Gnanasambandam's APIs to access Datla's linked entries and generate these outputs. *Supra* §VIII.A.2.i; EX1007, 100:24-34; EX1003 ¶227. Datla's ranked diagnoses, recommended tests, and treatment plans are thus the claimed healthcare determination, and each qualifies as a recommendation, evaluation, result, or conclusion. EX1003 ¶227.

B. Ground 2: Claims 4-5 are Unpatentable Over Datla, Goldberg, Gnanasambandam, and Kim

Claims 4-5 would have been obvious over Datla, Goldberg, Gnanasambandam, and Kim. In the combination, Kim supplies ontology identifiers and synonyms for recognizing semantically equivalent concepts across sources. EX1012 ¶¶[0041], [0050]-[0055], [0060]; EX1003 ¶¶228-233.

1. Motivation to Combine

A POSITA would have combined these references because, first, they address the same field and problem: Kim concerns medical knowledge graphs supporting clinical decision-making, and Datla and Goldberg ingest clinical concepts from heterogeneous sources. EX1012 ¶¶[0038]-[0039]; EX1005 ¶¶[0030], [0034], [0040]; EX1006, 5:47-62; EX1003 ¶230.

Second, Datla and Goldberg already point toward standard ontologies. Datla states: "the system may extract term frequency-inverse document frequency

(TFIDF) weighted topical keywords from the given descriptions, summaries or notes and map them to categories represented in one or more ontologies, including but not limited to the following controlled clinical ontologies: SNOMED CT for diagnoses, LOINC for tests, and/or RxNorm for treatments.” EX1005 ¶[0054]; EX1003 ¶231. Goldberg derives graphs from SNOMED and LOINC and a third clinical probability graph from medical publications. EX1006, 6:12-24; EX1003 ¶231. Kim supplies the detail of storing the ontology code and synonyms in the graph entry. EX1012 ¶¶[0051], [0054]-[0055]; EX1003 ¶231.

Third, the combination applies a known technique for its established purpose with predictable results: Kim explains that annotation with unique identifiers can be semi-automated using MedCAT, which is “based on an algorithm mapping the terms of any kind of textual data to the concepts of existing ontologies.” EX1012 ¶[0053]; EX1005 ¶¶[0031]-[0032]; EX1003 ¶232.

2. Claim 4

Kim discloses concepts represented as nodes that “may be identified by a unique ontology code” and explains that “[u]sing unique node ids/codes, e.g. ontology codes, allows the unambiguous identification of every concept instance.” EX1012 ¶¶[0041], [0052]; EX1003 ¶235. Kim further teaches that “the entries of the graph database may themselves be annotated with identifiers from several different ontologies,” such as “the SNOMED CT code SCTID: 93880001” and “the

RadLex code RID45686” for the same clinical concept. EX1012 ¶¶[0051], [0060]; EX1003 ¶236. Kim also teaches that “[o]nce an ontology code (unique identifier) has been assigned ... related concepts as represented in the graph database can be suggested.” EX1012 ¶[0052]; EX1003 ¶237.

It would have been obvious to include, in each Datla diagnostic-factor node, the unique ontology identifier corresponding to that factor, taught by Kim, for several reasons. EX1005 ¶[0054]; EX1012 ¶¶[0041], [0051]; EX1003 ¶238. First, the identifier resolves terminology variation: Datla acknowledges that “certain diagnosis terms from MIMIC-II do not exactly match the Wikipedia page titles.” EX1005 ¶[0040]; EX1003 ¶240. Kim teaches that semantically equivalent expressions receive the same ontology identifiers. EX1012 ¶[0050]; EX1003 ¶240. Kim’s identifier would allow the same diagnostic factor to be recognized across differently worded sources. EX1012 ¶[0050]; EX1005 ¶[0040]; EX1003 ¶240.

Second, the identifier permits matching through a shared code rather than text alone: the combined system would match an extracted concept carrying an ontology code to a diagnostic-factor entry carrying the same code, providing a common key for reconciling concepts that sources describe differently. EX1005 ¶¶[0040], [0054]-[0055]; EX1012 ¶¶[0041], [0050]-[0051]; EX1003 ¶241. Third, the identifier connects the entry to ontology structure: Goldberg’s FIG. 6 shows SNOMED “is-a” relations among clinical concepts, and Kim explains that an assigned ontology code

permits related concepts to be suggested. EX1006, 9:50-52, FIG. 6; EX1012 ¶[0052]; EX1003 ¶242.

A POSITA would have reasonably expected success: Goldberg demonstrates combining clinical knowledge graphs with standard ontologies, and Kim identifies MedCAT as an available tool that maps textual terms to existing ontology concepts. EX1006, 5:47-62, 6:12-24; EX1012 ¶[0053]; EX1003 ¶243. The identifier would be a node property and would not alter Datla's operation. EX1005 ¶¶[0032], [0036]; EX1003 ¶243.

3. Claim 5

Kim discloses that “the graph database includes synonyms, translations, concepts and relationships.” EX1012 ¶[0054]. Kim ties synonyms to entries: “in order to add translations or synonyms for terms of existing ontology concepts to one or more entries of the graph database, the respective concept might have to be identified using existing terms describing it.” EX1012 ¶[0055]. Kim teaches searching “all preexisting concept synonyms within the graph database” and explains that “synonyms and translations are also covered by the terminology system of the graph database and can be matched to the entered node labels.” EX1012 ¶¶[0054], [0060]; EX1003 ¶245.

In the combined Ground 1 system, each Datla diagnostic-factor node would store at least one synonym of its factor, as Kim teaches—for example, the synonyms

by which fever is described in the medical literature and in the corresponding ontology entry. EX1003 ¶246. Because Datla stores each diagnostic factor and medical condition as a separate node (*supra* element [1f]; EX1005 ¶[0031]), each diagnostic factor entry “includes at least one synonym” of the factor it represents. EX1003 ¶246.

A POSITA would have made this modification for at least three reasons. First, it avoids duplicate nodes: Kim teaches that “the addition of redundant concepts could be prevented by searching through all preexisting concept synonyms within the graph database.” EX1012 ¶[0054]. Datla’s graph “may be updated with new journal articles, new online sources, or other possible sources of new information.” EX1005 ¶[0032]. Without synonyms, “pyrexia” could be added as a separate node from “fever,” fragmenting the edges associated with the factor. Storing synonyms on each entry would allow the system to recognize a differently worded factor as an existing entry. EX1003 ¶247.

Second, the modification improves matching of patient input. Datla queries its graph with symptoms extracted from clinical notes and acknowledges that “certain diagnosis terms from MIMIC-II do not exactly match the Wikipedia page titles.” EX1005 ¶¶[0040], [0052], [0055]. Kim teaches that synonyms “can be matched to the entered node labels,” and that “medical synonym dictionaries can be applied to infer most likely matches.” EX1012 ¶¶[0060], [0073]. Stored synonyms

would thus improve matching of differently worded input to the correct diagnostic-factor entry. EX1003 ¶248. Third, the modification complements claim 4: after linking each diagnostic-factor node to an ontology entry, storing that entry's terms with the node would be natural, as Kim adds synonyms "for terms of existing ontology concepts." EX1012 ¶[0055]; EX1003 ¶249.

A POSITA would also have had a reasonable expectation of success because storing one or more text strings as a node property is routine, and Kim's graph database already "includes synonyms" and allows new synonyms to be added. EX1012 ¶[0054]; EX1003 ¶250. The modification would leave Datla's system otherwise unchanged. EX1005 ¶¶[0032], [0036].

C. Ground 3: Claim 6 is Unpatentable Over Datla, Goldberg, Gnanasambandam, and Van Assel

Claim 6 would have been obvious over Datla, Goldberg, Gnanasambandam, and Van Assel, which supplies the present, absent, and unknown states for the negation attribute. *Supra* §VIII.A; EX1011 ¶¶[0245], [0248], [0253]; EX1003 ¶¶251-252.

Claim 6 is disjunctive, so a negation attribute suffices. The '882 patent describes negation as "a binary value indicating whether the factor is present or not present." EX1001, 21:31-32; EX1003 ¶253. Datla's system may "filter out negated clinical concepts in order to give more weight to positive clinical manifestations,"

which requires classifying each concept as present or absent. EX1005 ¶[0054]; EX1003 ¶254.

Van Assel records that status as a value for each item of medical data, assigning “1, -1, or 0 to the extracted concept to indicate whether the concept is validly present (1), validly absent (-1) or this is unknown (0),” and representing node states as PRESENT or ABSENT. EX1011 ¶¶[0245], [0248], [0253], [0122]; EX1003 ¶255. It would have been obvious to store this status as a negation attribute in each Datla diagnostic-factor entry. EX1005 ¶[0054]; EX1003 ¶255.

A POSITA would have made this combination for three reasons. First, Datla and Van Assel both address computer-implemented diagnosis using extracted clinical concepts; Van Assel extracts concepts from input text by NLP and links diseases, symptoms, and risk factors in a knowledge graph. EX1011 ¶¶[0110], [0113], [0115]; EX1005 ¶¶[0031], [0052]-[0055]; EX1003 ¶256. Second, storing negation status as an attribute lets the same reusable diagnostic-factor node represent “fever” and “no fever,” preserving Datla’s graph structure. EX1005 ¶¶[0031], [0052], [0055]; EX1003 ¶256. Third, Van Assel treats absence as diagnostic evidence: “PRESENT becomes probability 1 and ABSENT becomes probability 0.” EX1011 ¶¶[0112], [0248]; EX1003 ¶256.

A POSITA would have reasonably expected success: Van Assel implements present, absent, and unknown values, Datla’s NLP already produces the negation

status, and a stored value would not alter Datla's weighted edges or activation-and-decay traversal. EX1011 ¶¶[0245], [0248], [0253]; EX1005 ¶¶[0032], [0036], [0054]; EX1003 ¶257.

D. Ground 4: Claims 7 and 15-20 are Unpatentable Over Datla, Goldberg, Dang, and Gnanasambandam

Claims 7 and 15-20 would have been obvious over Datla, Goldberg, Dang, and Gnanasambandam. EX1003 ¶¶258-355. In the combination, Datla supplies the medical-evidence corpus, NLP processing, graph, patient information, and diagnostic outputs; Goldberg supplies the ontology and clinical-relationship teachings; Dang supplies explicit context and feature-node structures; and Gnanasambandam supplies API access. *Id.* ¶¶258-263.

1. Motivation to Combine

A POSITA would have combined Datla, Goldberg, and Gnanasambandam as explained in Ground 1 (*supra* §VIII.A.1; EX1003 ¶259) and would have added Dang because Dang builds a symptom-disease graph from “electronic documents constituting medical guidelines,” extracts diseases and symptoms, and models their relations. EX1008 ¶[0025]; EX1003 ¶260.

Dang supplies a context node linked to disease and symptom nodes, intermediate feature nodes with disease-specific conditional probabilities, context nodes detected during diagnosis, and formulas for feature and disease scores. EX1008 ¶¶[0027]-[0031], [0047], [0049]-[0050], FIGS. 1A-1B; EX1003 ¶261.

These features serve Datla's goal "to improve the accuracy of the recommendations relative to the patient scenario of interest." EX1005 ¶[0061]; EX1003 ¶262. Success would have been reasonably expected because the combination uses ordinary node types and edges already taught by Datla and Dang. EX1005 ¶¶[0031]-[0032]; EX1008 ¶¶[0027], [0047]; EX1003 ¶263.

2. Independent Claim 15

a. Element [15pre]

As discussed for element [1pre], *supra* §VIII.A.2.a, Datla discloses a computer system for determining a patient's state. EX1005 ¶[0001]; EX1003 ¶¶265-266.

b. Element [15a]

Element [15a] is substantively the same as element [1a]. *Supra* §VIII.A.2.b. Datla's system 500 includes processor 530, which executes diagnostic functions, and memory 540, which stores program instructions. EX1005 ¶¶[0078]-[0081]; EX1003 ¶¶267-268.

c. Element [15b]

Element [15b] is substantively the same as elements [1b]-[1c], except that claim 15 recites "extract from" rather than "receive" or "retrieve." *Supra* §§VIII.A.2.c-d. Datla describes extracting diagnostic factors indicative of medical conditions from its medical corpus. EX1005 ¶[0034]; EX1003 ¶¶269-270.

d. Element [15c]

Element [15c] is substantively the same as the published-journal, taxonomy, hierarchy, and indicative-relationship limitations of elements [1b] and [1d], including [1d]’s second clause. *Supra* §§VIII.A.2.c, VIII.A.2.e. Datla identifies medical journals and other evidence sources, and Goldberg describes distinct ontology-based taxonomies and clinical relationships derived from medical publications. EX1005 ¶¶[0030], [0033], [0047]; EX1006, 5:51-58, 6:12-24; EX1003 ¶¶271-272.

e. Element [15d]

Element [15d] is substantively the same as element [1e]. *Supra* §VIII.A.2.f. Datla’s directed graph of clinical concepts and relations and Goldberg’s hybrid knowledge graph with ontology relations and clinical pathways provide the claimed graph database cross-linking diagnostic factors and medical conditions arranged in different hierarchies. EX1005 ¶¶[0031], [0035]; EX1006, 12:44-54, 15:40-65; EX1003 ¶¶273-274.

f. Element [15e]

Element [15e] is substantively the same as elements [1f]-[1g] with three minor differences. *Supra* §§VIII.A.2.g-h; EX1003 ¶¶275-276.

First, claim 15 requires each diagnostic factor and medical condition to be stored as “its own node”; Datla expressly describes each symptom, condition,

diagnosis, test, procedure, medication, and other clinical concept as a node. EX1005 ¶[0031]; *supra* §VIII.A.4 (claim 3); EX1003 ¶277.

Second, claim 15 expressly requires that medical conditions be linked to diagnostic factors, which Datla satisfies because a symptom such as fever is connected by edges to hundreds of other nodes. EX1005 ¶[0031]; EX1003 ¶278.

Third, the negative limitation applies to each diagnostic factor node. Datla places relationship information on the edges, so the same factor node can connect to many conditions without storing condition-specific information. EX1005 ¶¶[0031]-[0032]; EX1003 ¶¶279-280. The separate demographics node addressed for [15f] reinforces that condition-specific information is kept outside the reusable factor node. EX1003 ¶281.

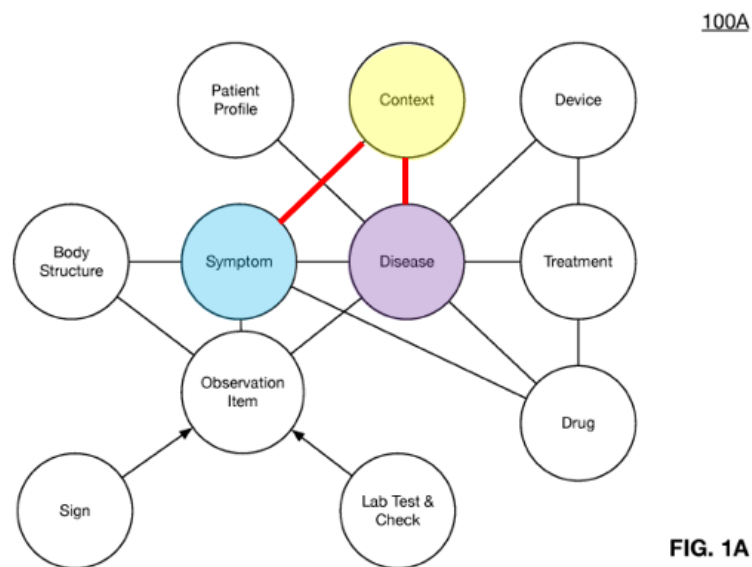
g. Element [15f]

Element [15f] requires demographics indicating a medical condition on the basis of a diagnostic factor, stored in a demographics node located between the condition node and the diagnostic-factor node. Datla receives patient symptoms and demographic parameters, including age, height, weight, medical background, and sex, through its user interface, and its NLP engine extracts them. EX1005, claim 1, ¶¶[0050]-[0052]; EX1003 ¶284. Datla uses that information because “if a disease is not common for a demographic, its rank is lowered,” and states that demographic

tuning improves recommendations for the patient scenario. EX1005 ¶¶[0006], [0061]; EX1003 ¶285.

Datla queries knowledge graph 310 using the extracted symptoms and demographic information and filters candidate articles by criteria including “location, gender” and other contextual information. EX1005 ¶¶[0037], [0076]; EX1003 ¶¶286-288. Although Datla does not expressly state how demographic knowledge is represented in the graph, storing it in a separate node was a routine graph-design choice for a POSITA implementing Datla’s demographic comparison. EX1003 ¶289.

Dang provides an example of this routine choice: its FIG. 1A meta-model includes disease, symptom, and context nodes connected by edges representing relations between the concepts. EX1008 ¶[0027]; EX1003 ¶¶290-291.



EX1008 FIG. 1A (annotated)

A context node linked to a disease node and a symptom node is “between” those nodes in the relevant graph path, consistent with the ’882 patent’s FIG. 4A. EX1008 ¶[0027], FIG. 1A; EX1001, 18:29-53, 25:25-30; EX1003 ¶293. Dang’s FIG. 1B likewise includes factual nodes, including symptom, test, and context nodes, together with feature nodes and disease nodes. EX1008 ¶¶[0028]-[0031], FIG. 1B; EX1003 ¶292.

A POSITA would understand that Dang’s context nodes contain information used in diagnosis. EX1008 ¶[0047]; EX1003 ¶294. Because Datla requires demographic knowledge to query its graph and adjust rankings, it would have been obvious to store that knowledge in Dang’s context node, and Dang’s example of a 60-year-old patient confirms that age is the type of contextual information used in this graph. EX1005 ¶¶[0061], [0076]; EX1008 ¶¶[0027], [0036], [0047]; EX1003 ¶¶295-296.

Goldberg confirms why demographics belong between the factor and condition. Goldberg’s FIG. 4 assigns the “Periods of life (qualifier value):ADULTHOOD” feature different likelihoods for celiac disease and Crohn’s disease. EX1006, 10:35-50, FIG. 4; EX1003 ¶¶298-300. A demographic’s significance thus depends on the factor-condition relationship, which a factor node linked to the disease alone cannot capture. EX1006, FIGS. 4, 11; EX1003 ¶¶300-301.

A POSITA would have made this modification for at least three reasons. First, Datla requires demographic knowledge in or with its graph but leaves the representation unspecified, and Dang supplies a known context-node structure for that purpose. EX1005 ¶¶[0052], [0061], [0076]; EX1008 ¶¶[0027], [0047]; EX1003 ¶304. Second, storing demographics for each factor-condition relationship would improve diagnostic accuracy by accounting for differences among diseases and allowing the comparison during traversal, consistent with Datla's goal. EX1005 ¶[0061]; EX1006, FIGS. 4, 11; EX1003 ¶305. Third, no redesign is required: Datla already uses nodes and weighted edges, and Dang's context node is another edge-connected node type. EX1005 ¶¶[0031]-[0032]; EX1008 ¶¶[0027], [0047]; EX1003 ¶306. Success would have been reasonably expected because Datla, Dang, and Goldberg each describe computer-implemented clinical knowledge graphs for diagnosis, and storing an age range or sex in a node and comparing it with extracted patient demographics was routine. EX1005 ¶[0052]; EX1006, 6:10-34; EX1008 ¶[0036]; EX1003 ¶307.

h. Element [15g]

Element [15g] is substantively the same as element [1h] but refers to access to linked diagnostic factors and medical conditions rather than linked separate entries. *Supra* §VIII.A.2.i. Gnanasambandam publishes APIs that use artificial intelligence to perform analytics based on a medical knowledge graph and provides

them through a computing-device interface. EX1007, 100:24-34, 101:12-37, 102:22-24; EX1003 ¶¶309-310.

i. Element [15h]

Datla discloses matching patient data to diagnostic-factor nodes by assigning an activation weight to a node comprising extracted patient symptoms and expanding from those nodes through the graph. EX1005 ¶¶[0055], [0057], [0067]; EX1003 ¶312. The '882 patent describes a chart as an EHR or EMR record containing clinical notes. EX1001, 22:53-67, 6:32-34. Datla processes clinical notes and MIMIC admission data, and Dang expressly uses a patient's EMR containing symptoms, test results, and age. EX1005 ¶¶[0034], [0039], [0048], [0057]; EX1003 ¶¶313-315.

Gnanasambandam confirms this: it receives an EMR with patient notes, processes the notes to obtain indicia, identifies a possible condition by comparing the indicia with a knowledge graph, and can retrieve the EMR through an API. EX1007, 56:62-64, 57:41-45, 61:16-18, 61:30-40; EX1003 ¶316. A POSITA would have been motivated to obtain patient data directly from the chart because Datla already analyzes clinical notes, Dang and Gnanasambandam show EMR-based knowledge-graph diagnosis, and using the chart reduces manual entry and fits the clinical workflow. EX1005 ¶¶[0034], [0057]; EX1008 ¶[0036]; EX1007, 56:62-64, 61:16-18; EX1003 ¶317. The combined system matches the patient's demographics

to the demographics node and symptoms to diagnostic-factor nodes. EX1001, 24:40-44; EX1005 ¶¶[0051], [0076]; EX1008 ¶[0047]; EX1006, claim 1, 8:14-16; EX1003 ¶¶318-319.

Finally, Datla provides ranked diagnoses through a user interface, Dang outputs a top disease list, and Gnanasambandam presents diagnosis-related information on a computing device. EX1005 ¶¶[0011], [0057], [0059], [0062]; EX1008 ¶[0056]; EX1007, 61:30-40; EX1003 ¶¶320-322.

3. Claim 16

Claim 16 first refers to a rank of the likelihood that the patient has a medical condition, but then refers to “said rank of said diagnostic factors.” The antecedent basis and the two uses of “rank” are therefore imperfect, but the combination meets the claim under either reading. EX1003 ¶¶324-326.

Datla provides a ranked list of medical conditions and stores condition-specific relationship strength as weighted edges. EX1005 ¶¶[0007], [0032]; EX1003 ¶327. Moving that value from the edge to an intermediate node is a routine graph-design choice. Dang supplies factual, feature, and disease nodes, with disease-specific conditional probabilities $P(f|d)$ and feature-level calculations used to determine disease probabilities, sort the possible diseases, and output the top disease list. EX1008 ¶¶[0028]-[0032], [0049]-[0050], [0056], FIG. 1B; EX1003 ¶¶328-330.

It would have been obvious to hold P(f|d) in the intermediate feature node because the value is already specific to the disease and the feature node lies between the disease and symptom nodes. EX1008 ¶¶[0031]-[0032], FIG. 1B; EX1003 ¶331. The modification would improve transparency, preserve condition-independent diagnostic-factor nodes, and use a routine node-property operation with a reasonable expectation of success. EX1005 ¶¶[0031]-[0032], [0057], [0069]-[0071]; EX1008 ¶¶[0049]-[0050]; EX1003 ¶¶332-333.

4. Claim 17

Claim 17 is substantively the same as the NLP-initialization limitation addressed for claim 26 (*infra* §VIII.F.4), and the underlying extraction and graph architecture are supplied by Datla and Dang.

Datla builds its graph from corpus text and uses an NLP engine to extract clinical concepts. EX1005 ¶¶[0030], [0032], [0052], [0065], [0081]; EX1003 ¶335. A POSITA would have understood or found obvious that Datla uses NLP to extract corpus information to construct its graph, because Datla already uses an NLP engine on clinician input and NLP was well known for this purpose. EX1003 ¶¶335-336.

Dang recognizes features by “recognizing or allocating nodes” in the symptom-disease knowledge graph at step 402, and it uses semantic matching between input text and existing graph nodes. EX1008 ¶¶[0009], [0042], [0047], FIG. 4; EX1003 ¶¶337-338. Initializing Datla’s NLP engine with existing diagnostic-

factor nodes would avoid duplicate nodes, keep the graph vocabulary consistent, and make the extracted factors directly usable in Datla's node-based query. EX1005 ¶¶[0032], [0055]; EX1008 ¶¶[0009], [0042], [0047]; EX1003 ¶339.

5. Claim 18

Claim 18 is substantively the same as claim 12 but depends from claim 15 and recites "nodes" rather than "entries," differences that do not affect the analysis. *Supra* §VIII.A.8. Datla's graph expressly comprises nodes, Goldberg's SNOMED-based knowledge graph covers hundreds of thousands of medical terms, and the added context and feature nodes only increase the node count. EX1005 ¶¶[0030]-[0032]; EX1006, 1:54-56. Scaling the known graph architecture to the claimed size would have been routine. EX1003 ¶¶340-341.

6. Claim 19

The same disclosures discussed for claim 18 satisfy the higher threshold of claim 19. Goldberg describes SNOMED as covering hundreds of thousands of medical terms, and the '882 patent itself describes an actual graph database as containing many hundreds of thousands of nodes or more. Scaling the known graph architecture to that size would have been routine. EX1006, 1:54-56; EX1001, 27:67-28:3; EX1003 ¶¶342-343.

7. Claim 20

Claim 20 is substantively the same as claim 14, except that it depends from claim 15. *Supra* §VIII.A.10. The healthcare determination in element [15h] is the

displayed ranked diagnosis: Datla describes ranked medical conditions and diagnoses, recommends diagnoses and tests, and provides those outputs to the clinician. EX1005 ¶¶[0057], [0061]-[0063]; EX1003 ¶¶344-346. Dang likewise outputs a suspected disease list, which is a result and a conclusion. EX1008 ¶[0056]; EX1003 ¶347.

8. Claim 7

Claim 7 depends from claim 1, *supra* §VIII.A.2, and overlaps with element [15f]. A “demographics entry linked between” the condition and factor entries is at least as broad as [15f]’s “demographics node located between” those nodes, and Goldberg’s “Periods of life (qualifier value):ADULTHOOD” qualifier, with different likelihoods for celiac disease and Crohn’s disease, is demographics “indicating a type of person to which” a diagnostic factor occurs “in the context of” a medical condition. *Supra* §VIII.D.2.g; EX1006, 4:54-58, FIG. 4; EX1008 ¶[0027], FIG. 1A; EX1003 ¶¶351-352.

Claim 7 adds one requirement: the demographics are received as “input from a person via a computing device.” Datla extracts demographic parameters from patient input and lowers a disease’s rank “if a disease is not common for a demographic,” but does not describe a person entering demographic knowledge into the graph. EX1005 ¶¶[0007], [0061]; EX1003 ¶349. Goldberg does: its data curation module enables “the entry, editing, reviewing etc. of healthcare data from multiple-

sources into a structured database,” using “a templates based editor supporting data entry” designed for clinical facts including “demographic” facts. EX1006, 13:13-22. Goldberg’s Editor 320, “an interface in the form of a mobile app or web interface for data entry by community members,” is a computing device. *Id.*, 7:58-59; EX1003 ¶350.

A POSITA would have used Goldberg’s editor to populate the combined system’s demographics entries. Datla’s rank-lowering rule works only if the system already holds demographic knowledge to compare against; Goldberg supplies a known way to enter that knowledge and confirms that stored knowledge is compared with patient inputs such as “demographics.” EX1005 ¶[0061]; EX1006, 8:14-16, 13:17-22. This is the use of a known technique for its known purpose, with a reasonable expectation of success. EX1003 ¶353.

E. Ground 5: Claims 21-41 Lack Adequate Written Description

Claims 21-41 require a “medical evidence journal” that “provides different taxonomies” arranging diagnostic factors and medical conditions “in different hierarchies.” These claims should be canceled because the specification never describes such a journal. EX1003 ¶¶354-360.

The specification must “reasonably convey[] to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date,” as determined by “an objective inquiry into the four corners of the specification from

the perspective of a person of ordinary skill in the art.” *Ariad Pharms., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). It is not enough that the claimed subject matter would have been obvious from what is disclosed. *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571-72 (Fed. Cir. 1997).

Claim 21 requires that the diagnostic factor and medical condition entries “originate in at least one medical evidence journal, wherein said at least one medical evidence journal provides different taxonomies that arrange one or more of said diagnostic factors entries and/or one or more of said medical condition entries in different hierarchies.” Claim 32 imposes the same requirement on its “known and unknown diagnostic factor entries.” Claims 22-31 and 33-41 do not cure the defect.

By contrast, claims 1 and 15 attribute the “different taxonomies” to the “medical evidence sources” collectively and separately require that “a subset” of those sources “includes a published journal.” Claims 21 and 32 require that the journal itself provides the different taxonomies and hierarchies. EX1003 ¶355. In other words, claims 21-41 require a single journal that supplies multiple taxonomies with different hierarchies. The specification does not describe one. EX1003 ¶356.

First, when the specification identifies the source of a taxonomy or hierarchy, it is an ontology or code system, not a journal. The specification explains that “SNOMED-CT provides taxonomies of clinical terms” and that “one taxonomy provides a hierarchy of diagnostic factors and another taxonomy provides a

hierarchy of conditions.” EX1001, 4:13-27. Each EDF is linked “to a taxonomy of clinical concepts (e.g., SNOMED)” and carries “a unique identifier that links back to a medical taxonomy (e.g., SNOMED, SNOMED-X, LOINC, RxNorm, ICD, CPT, etc.).” *Id.*, 11:4-6, 20:30-35. EDFs “may also be connected to other ontologies, including but not limited to SNOMED-CT,” and “many EDFs are created anew and do not exist in other taxonomies.” *Id.*, 10:46-52; EX1003 ¶358.

Second, the specification treats journals as sources of narrative text from which concepts are extracted. The disclosed system pulls “textual medical evidence” from sources such as “JAMA Rational Clinical Evidence” and “BMJ Best Practice (or other British Medical Journal databases),” and the extractor “maps extracted concepts to these code systems or ontologies.” EX1001, 7:4-22. That text “may be free-form text, may be in narrative form.” *Id.*, 7:23-29. The only other reference to journal literature is that “a citation (or citations) of a scientific publication is extracted.” *Id.*, 8:22-24. The specification describes combining “ontologies and medical evidence sources” as separate categories, with linking “not found in ontologies.” *Id.*, 4:50-57; EX1003 ¶¶357, 359.

While the specification lists SNOMED-CT and LOINC alongside journal databases as possible evidence sources, that does not support these claims. EX1001, 7:4-12. The list treats those ontologies as sources distinct from the journals, and the claims require the journal itself to provide the different taxonomies. Disclosing

narrative journal text that is mapped onto separate ontologies does not show possession of a journal that provides different taxonomies arranged in different hierarchies. At most, a POSITA might regard that arrangement as an obvious variant, which is insufficient. *Lockwood*, 107 F.3d at 1571-72. A POSITA therefore would not have understood the inventors to possess the claimed subject matter and claims 21-41 are unpatentable under 35 U.S.C. § 112(a). EX1003 ¶¶359-360.

F. Ground 6: Claims 21-22 and 26-31 Are Unpatentable Over Datla, Dang, Gnanasambandam, and MacRae

Claims 21-22 and 26-31 would have been obvious over Datla, Dang, Gnanasambandam, and MacRae. EX1003 ¶¶361-436. Datla supplies the corpus, graph, weighted links, and ranked diagnostic output; Dang supplies EHR-based factor detection, semantic matching, context nodes, and conditional probabilities; Gnanasambandam supplies API access; and MacRae supplies a published BMJ Open journal article. EX1003 ¶361.

1. Motivation to Combine

A POSITA would have combined Datla, Dang, and Gnanasambandam for the reasons stated for Grounds 1 and 4. *Supra* §§VIII.A.1, VIII.D.1. Datla builds its graph from “any source of information, including but not limited to medical journals,” and weights an edge when two nodes “appear within ... the same medical journal.” EX1005 ¶¶[0030], [0032]. MacRae is a BMJ Open journal article of exactly that kind. EX1013, 1. Adding MacRae to Datla’s corpus requires no

modification of Datla's system with the predictable result of graph entries originating in a published medical journal. EX1003 ¶¶362-363.

2. Independent Claim 21

a. Element [21pre]

Element [21pre] is identical to [15pre] and is met for the same reasons. *Supra* §VIII.D.2.a; EX1003 ¶¶365-366.

b. Element [21a]

Element [21a] is met for the reasons given for [1a] and [15a]. *Supra* §§VIII.A.2.b, VIII.D.2.b; EX1003 ¶¶367-368.

c. Element [21b]

For the reasons given for [15h], the combination receives a portion of a patient EHR. *Supra* §VIII.D.2.i. Datla processes MIMIC discharge notes drawn from “comprehensive clinical data obtained from hospital medical information systems” and actual admission notes, and Dang uses a patient's “electronic medical record (EMR)” that “indicates (or confirms)” the patient's symptoms. EX1005 ¶¶[0039], [0048]; EX1008 ¶[0036]. Datla's NLP engine “extracts at least one patient symptom from the received information,” producing factors known to be present, and its system “may ... filter out negated clinical concepts in order to give more weight to positive clinical manifestations,” which requires first identifying factors documented as absent. EX1005 ¶¶[0052], [0054]; EX1003 ¶¶369-371.

d. Element [21c]

Element [21c] is substantively the same as the matching step of [15h]. *Supra* §VIII.D.2.i. Datla assigns an activation weight “to a node of the knowledge graph comprising the extracted one or more patient symptoms,” and Dang detects nodes by “measuring, using semantic matching, a similarity between an input text [and] one or more nodes in the knowledge graph data structure.” EX1005 ¶¶[0055], [0057]; EX1008 ¶¶[0009], [0047]. Claim 21’s “entries” are Datla’s nodes. *Supra* §VIII.A.4; EX1003 ¶¶372-375.

e. Element [21d]

Element [21d] combines the cross-linking of [1f] and [15e] with the negative limitation of [1g] and [15e], applied to “each” factor entry as in [15e]. *Supra* §§VIII.A.2.g, VIII.A.2.h, VIII.D.2.f. Datla’s fever node “will be connected by edges to hundreds of other nodes,” and the condition-specific relationship is carried on the weighted edge, not the node. EX1005 ¶¶[0031]-[0032]. Dang likewise associates its conditional probability $P(f|d)$ with the disease-feature connection, and in the combination that value is stored on Datla’s edges (*infra* §VIII.F.2.j), leaving each factor entry condition-independent. EX1008 ¶[0031]; EX1003 ¶¶376-379.

f. Element [21e]

Datla includes medical journals in its corpus. EX1005 ¶¶[0030], [0032]. With MacRae added, the factor and condition entries originate in a medical evidence journal: MacRae’s Table 1 lists “Asthma” within the “Wheeze-related illness”

category, and MacRae discusses the symptoms and medications associated with that illness. EX1013, 4, 7-8; EX1003 ¶¶380-382.

g. Element [21f]

As explained in Ground 5, the specification never describes a journal that provides different taxonomies. *Supra* §VIII.E. For this ground, Petitioner applies Patent Owner’s infringement reading where it contends that MacRae places “wheezing-ill” in a taxonomy based on its “classification of consultation” hierarchy (FIG. 1) and places “wheeze” and wheeze-related conditions in a Table 1 hierarchy of respiratory classification categories. EX1019, 88-93;² EX1013, 4, FIG. 1. Under that reading, MacRae alone satisfies [21f] once included in Datla’s corpus.

h. Element [21g]

For the reasons given for [1d], Datla discloses factors discussed in its sources as indicative of conditions and ties that relationship to journal text by weighting edges when nodes “appear within ... the same medical journal.” *Supra* §VIII.A.2.e; EX1005 ¶[0032]. MacRae lists “Asthma” within “Wheeze-related illness” and explains that “the medications prescribed and symptoms described were highly

² Patent Owner’s additional reliance on SNOMED-CT is irrelevant because it is not a journal. EX1003 ¶¶383-386.

predictive for Wheeze illness and for few other conditions.” EX1013, 4, 7-8; EX1003 ¶¶387-389.

i. Element [21h]

Element [21h] is substantively the same as [1h] and [15g], except that it recites access to the factor and condition entries, which are the linked entries addressed there. *Supra* §§VIII.A.2.i, VIII.D.2.h; EX1003 ¶¶390-391.

j. Element [21i]

Datla traverses from matched symptom nodes to linked conditions, performing “all one-hop expansion of the symptom nodes” along edges “weighted based on a relationship between the nodes.” EX1005 ¶¶[0032], [0036], [0055], [0057]. Dang supplies a weight value indicative of causation: each disease-feature connection “may have a corresponding conditional probability,” indicating “the likelihood of the feature ... occurring when the disease ... [is] observed.” EX1008 ¶[0031].

A POSITA would have stored that probability on Datla’s symptom-condition edges and collected it during traversal for two reasons. First, Datla’s co-occurrence weight does not capture direction, whereas $P(f|d)$ captures the disease-to-finding relationship on which diagnosis depends. Second, Dang teaches that combining its TF-IDF and Bayesian approaches “improve[s] diagnosis accuracy.” EX1008

¶[0040]. Reading a stored edge value during traversal was routine, so a POSITA would have reasonably expected success. EX1003 ¶¶392-395.

k. Element [21j]

Datla's control module "controls the accumulation of activations at one node," and Dang expressly computes "Confidence of disease = Sum (Confidence of evidence * TF-IDF)." EX1005 ¶[0071]; EX1008 ¶[0050]. A POSITA would have summed the collected weights for each condition as Dang teaches because an explicit sum lets each condition's total be broken down into each matched factor's contribution, making the ranking transparent to the clinician. Adding values is routine. EX1003 ¶¶396-399.

l. Element [21k]

Datla extracts "top ranked diseases and medical conditions" and provides the ranked conditions to the clinician via a user interface "such as a speaker or screen," and Dang "sorts (step 608) the PDL by probability rate" and outputs it "via a graphical user interface." EX1005 ¶¶[0062], [0072]; EX1008 ¶[0056]. The combined system displays the conditions in order of the [21j] totals, which is a healthcare determination for the reasons given for claim 14. *Supra* §VIII.A.10; EX1003 ¶¶400-403.

3. Claim 22

The combined system computes each condition's total weight value. *Supra* §VIII.F.2.k. Dang reports disease-specific probability values, e.g., a likelihood "of

6.78 that Q is indicative of the flu and ... 2.01 that Q is indicative of allergic rhinitis.” EX1008 ¶¶[0038], [0056]. Displaying each value beside its condition would have been obvious because the value is already in memory and ordering alone does not show whether conditions are nearly tied, consistent with Datla’s goal of presenting diagnoses “in addition to the rationale for each option.” EX1005 ¶¶[0003], [0062]; EX1003 ¶¶404-407.

4. Claim 26

Claim 26 is substantively the same as claim 17’s NLP limitations, and the same analysis applies, with “diagnostic entries” referring to [21c]’s diagnostic factor entries. *Supra* §VIII.D.4. Datla’s NLP engine extracts the patient’s symptoms, and Dang detects factual nodes from patient complaint records by semantic matching against existing graph nodes, a known, working technique. EX1005 ¶¶[0052], [0055]; EX1008 ¶¶[0009], [0047]. A POSITA would have initialized Datla’s NLP with the graph’s factor entries because Datla’s query works only when an extracted symptom corresponds to a node, Datla acknowledges that free-text terms “do not exactly match” graph concepts, and the combination already matches factors this way under [21c]. EX1005 ¶¶[0040], [0055]; *supra* §VIII.F.2.d; EX1003 ¶¶408-413.

5. Claim 27

Claim 27’s “entry” and description of the demographics do not change the [15f] analysis. *Supra* §VIII.D.2.g. Goldberg is not needed: Dang’s Context node is

linked to both the Disease and Symptom nodes and is detected as a factual node, and Datla supplies the reason to populate it with demographics because it uses demographic parameters to query its graph and lowers a disease's rank when it "is not common for the demographic." EX1008 ¶¶[0027]-[0029], [0047], FIG. 1A; EX1005 ¶¶[0072], [0076]; EX1003 ¶¶414-416.

6. Claim 28

The recited "said display" is [21k]'s ranked display, and the claim is met by its first alternative, patient diagnosis. Datla provides "a clinical diagnosis of a patient's symptoms," and Dang's suspected disease list supports "a more targeted medical diagnosis." EX1005 ¶¶[0001], [0028], [0057]; EX1008 ¶[0025]. A ranked differential of a patient's likely conditions displayed to the clinician is a display for patient diagnosis. *Supra* §VIII.F.2.1; EX1003 ¶¶422-426.

7. Claim 29

The claim 12 analysis applies to claim 29, which differs only in its parent. *Supra* §VIII.A.8. Datla analyzes "all pages including and under the master top category" of clinical medicine, its fever node alone connects to "hundreds of other nodes," and its graph is updated "with new journal articles." EX1005 ¶¶[0030]-[0032]. Additional entries are more instances of the same node types, and the '882 patent attaches no significance to the threshold. EX1003 ¶¶427-430.

8. Claim 30

Claim 30 is the same as claim 13 but for its parent. For the reasons given for claim 29, Datla's ever-growing clinical-medicine graph and routine scaling satisfy the higher threshold. *Supra* §§VIII.A.9, VIII.F.7; EX1005 ¶¶[0030]-[0032]; EX1003 ¶¶431-433.

9. Claim 31

Claim 31 is the same as claim 14, and the same analysis applies to the ranked display of [21k]. *Supra* §§VIII.A.10, VIII.F.2.1; EX1005 ¶¶[0007], [0011], [0057], [0061]; EX1003 ¶¶434-436.

G. Ground 7: Claims 23-24 Are Unpatentable Over Datla, Dang, Gnanasambandam, MacRae, and Kim

Claims 23-24 would have been obvious over the Ground 6 combination (*supra* §VIII.F) in view of Kim. EX1003 ¶¶437-448. A POSITA would have added Kim for at least the first and third reasons given in Ground 2 (which do not depend on Goldberg). *Id.* ¶¶437-438.

1. Claim 23

For the reasons given for claim 4, it would have been obvious to include in each diagnostic factor entry a unique ontology identifier, as Kim teaches; that identifier is the “medical ontology link found in said matched diagnostic factor entry.” *Supra* §VIII.B.2; EX1012 ¶¶[0041], [0051]. Kim also teaches using that link to reach related concepts: “[o]nce an ontology code (unique identifier) has been

assigned ... related concepts as represented in the graph database can be suggested.” EX1012 ¶[0052]. Dang infers additional findings from detected ones based on “hyponymy relationships,” i.e., relationships between a specific term and its more general parent, and adds the result to the diagnostic node set “as an inferred evidential node.” EX1008 ¶¶[0010], [0048]-[0049], claim 9.

Reasoning from a present, specific factor to its parent is traversing upward, and adding the inferred node matches the inferred factor to another factor entry in the graph, as with [21c]. *Supra* §VIII.F.2.d. Once each entry carries Kim’s ontology identifier, the natural way to perform Dang’s hyponymy reasoning is to follow that identifier to the parent concept, because standard ontologies organize concepts in parent-child hierarchies and Datla already preserves source hierarchy in its graph. EX1005 ¶[0035], claim 16. Inferring a present parent factor captures matches that exact-term matching would miss, improving the accuracy Datla seeks, and a POSITA would have reasonably expected success. EX1003 ¶¶439-443.

2. Claim 24

Claim 24 is substantively the same as claim 5 but depends from claim 21 and omits “represented by said each diagnostic factor entry,” making it broader. The claim 5 analysis relies on Kim for the synonyms and Datla for the entries, and Dang’s role in the claim 21 combination does not affect it. *Supra* §VIII.B.3; EX1012 ¶¶[0054]-[0055], [0060]; EX1003 ¶¶444-448.

H. Ground 8: Claim 25 is Unpatentable Over Datla, Dang, Gnanasambandam, MacRae, and Van Assel

Claim 25 would have been obvious over the Ground 6 combination in view of Van Assel. EX1003 ¶¶449-456.

Claim 25 is substantively the same as claim 6 and only differs in that it depends from claim 21 instead of claim 1. The reasons for adding Van Assel and the claim 6 analysis of the claimed negation attribute apply equally for claim 25. *Supra* §VIII.C. Dang’s role in the combination for claim 21 does not affect that analysis; it reinforces it. Element [21b] recites diagnostic factors “known to be present or absent,” which the combination produces through Datla’s negation filtering, so storing Van Assel’s present/absent state on each matched factor entry records a status the system already uses. *Supra* §VIII.F.2.c; EX1005 ¶[0054]; EX1011 ¶¶[0245], [0248], [0253]; EX1003 ¶¶449-456.

I. Ground 9: Claims 32-33 and 38-41 are Unpatentable Over Zhong, Datla, Gnanasambandam, and MacRae

Claims 32-33 and 38-41 would have been obvious over Zhong, Datla, Gnanasambandam, and MacRae. EX1003 ¶¶457-555. In the combination, Zhong supplies the iterative question-generation system and its symptom-disease knowledge graph; Datla supplies condition-independent factor nodes and journal-based graph construction; Gnanasambandam supplies API access; and MacRae supplies a BMJ Open journal article. *Id.* ¶457.

1. Motivation to Combine

A POSITA would have combined Datla and Gnanasambandam, and added MacRae to Datla's corpus, for the reasons given for Grounds 1 and 6. *Supra* §§VIII.A.1, VIII.F.1; EX1003 ¶458.

A POSITA would also have combined Zhong with Datla because both build knowledge graphs linking symptoms to diseases and use them for clinical diagnosis, and a POSITA improving Zhong's graph would naturally look to Datla. EX1009, Abstract; EX1005 ¶¶[0001], [0028]; EX1003 ¶460. Zhong links symptom and disease nodes through edges carrying symptom-disease pair values, and Datla stores each symptom once, linking it to many conditions through separate weighted edges. EX1009, 3:20-25, claim 1; EX1005 ¶¶[0031]-[0032]. Adopting Datla's condition-independent architecture would store each factor once, reuse it across conditions, and let Zhong identify candidate symptoms shared by several diseases without duplicate entries. EX1003 ¶¶461-462.

Zhong's knowledge graph "may couple to external resources, such as various medical database or websites, for knowledge update such that the knowledge graph may be in line with current medical findings" but Zhong does not expressly describe how it was built. EX1009, 3:25-29; EX1003 ¶463. Datla builds its graph from a corpus that includes "medical journals." EX1005 ¶[0030]. Zhong's goal of staying current with medical findings would have led a POSITA to Datla's construction, a

routine technique used for its known purpose. EX1003 ¶¶463, 507-508. Zhong contemplates updating its graph from external sources, so a POSITA would add MacRae to the corpus for the same reasons discussed for Ground 6. *Supra* §VIII.F; EX1009, 3:25-29; EX1003 ¶469.

A POSITA would have added Gnanasambandam's APIs to the Zhong-Datla system. Zhong's system "may be an on-site system or a remote system communicating to the patient through various communication means, such as telephone, Internet," its "input data and/or output data may be remotely transmitted from one physical location to another," and its knowledge graph "may be a standalone component coupling to the question generation system." EX1009, 2:61-63, 3:14-17, 7:35-40; EX1003 ¶¶467, 515-516. Publishing APIs was the standard way to expose such a remote, modular service to EHR systems and other clinical applications, and Gnanasambandam teaches that deployment pattern for a medical knowledge graph. EX1007, 100:24-34, 102:22-24; EX1003 ¶¶465-466.

A POSITA would have reasonably expected success because each reference is used for its known purpose: Zhong's question-generation pipeline runs on a graph built and structured as Datla teaches and exposed through Gnanasambandam's APIs, yielding a predictable API-accessible system that determines next-best actions. EX1003 ¶¶462, 468, 508.

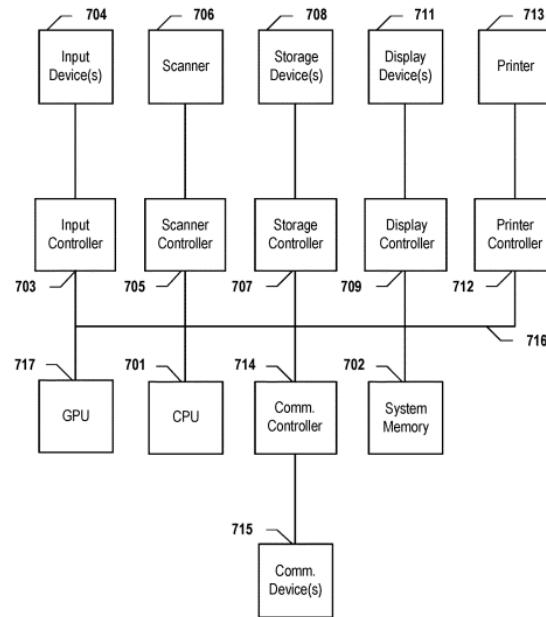
2. Independent Claim 32

a. Element [32pre]

To the extent limiting, Zhong discloses “[s]ystems and methods ... for question generation to obtain more related medical information based on observed symptoms from a patient.” EX1009, Abstract. Zhong iteratively identifies likely diseases, scores candidate symptoms not yet observed, and generates questions about them “until a disease is diagnosed or the patient reports no more observed symptoms.” *Id.*, 3:39-4:31, FIG. 3. Asking about previously unknown factors to advance the diagnosis is determining next-best actions for a medical condition. EX1003 ¶¶471-472.

b. Element [32a]

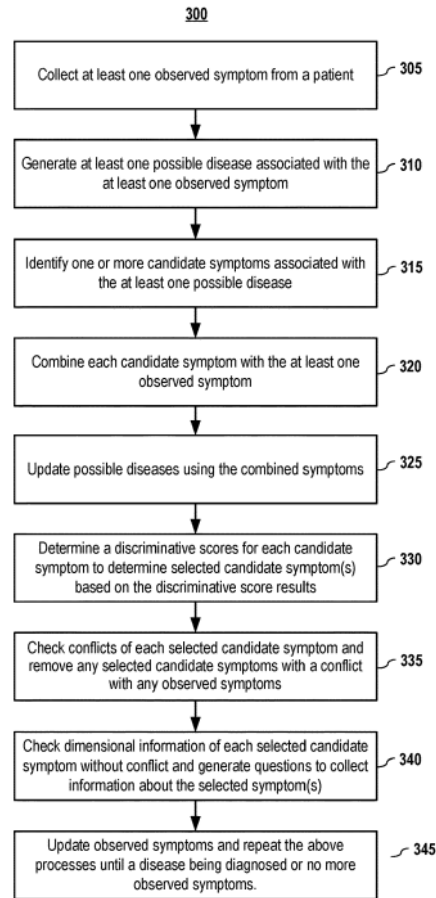
Zhong’s system 700 includes CPU 701 and system memory 702, and Zhong claims “one or more processors” and media storing “instructions which, when executed by at least one processor ... causes the steps to be performed.” EX1009, 6:67-7:3, 7:50-67, FIG. 7, claims 7, 12.



EX1009 FIG. 7

FIGS. 3-6 describe a single nested pipeline that performs the recited functions.

EX1003 ¶¶473-478. FIG. 3 illustrates the complete iterative loop:

**FIG. 3**

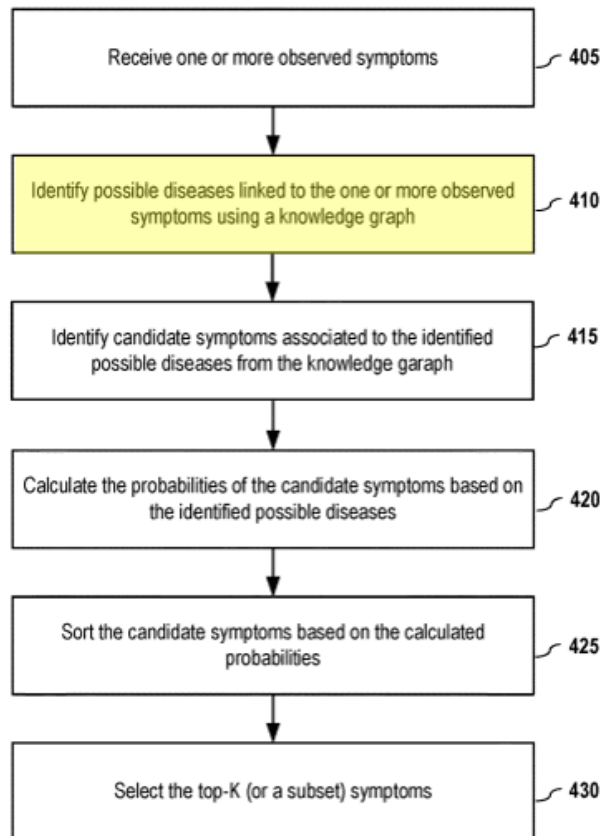
EX1009 FIG. 3

FIGS. 4-6 provide details on specific steps within FIG. 3: FIG. 4 expands on candidate-symptom generation and initial probability-based selection (Steps 310-315 of FIG. 3); FIG. 5 expands on discriminative scoring and refined selection (Step 330 of FIG. 3); and FIG. 6 expands on conflict filtering, question generation, and iterative updating (Steps 335-345 of FIG. 3). EX1003 ¶478.

c. Element [32b]

Before identifying candidate symptoms, Zhong narrows the disease set to those above a probability threshold in step 410. EX1009, FIG. 4; EX1003 ¶480.

Specifically, Zhong identifies “the most likely diseases are those diseases that have a probability above a threshold value.” EX1009, 4:40-46, FIG. 4 (step 410); EX1003 ¶481.



EX1009 FIG. 4 (annotated)

Zhong’s claim 1 confirms this by reciting “a set of likely diseases ... that have a probability above a threshold.” *Id.*, claim 1. All subsequent steps operate on those diseases. EX1003 ¶¶479-483.

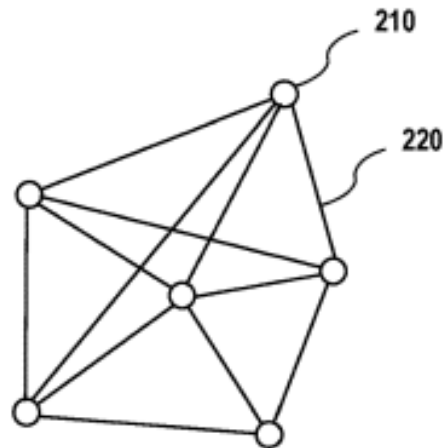
d. Element [32c]

Zhong collects “a set of one or more observed symptoms (So)” from the patient, and updates them “after the information is collected from the generated

questions,” so a symptom the patient denies becomes a factor known to be absent. EX1009, 3:41-44, 4:27-31. To compute disease probabilities at step 410, Zhong’s graph inference traverses the edges linking the observed symptom nodes to disease nodes, and steps 510-515 combine each candidate with the observed symptoms and query the graph again. *Id.*, 4:38-46, 5:10-16. Zhong identifies the known factor entries linked to each above-threshold disease. EX1003 ¶¶484-489. Zhong identifies all of them: step 415 defines candidates as the complement of the observed set, which requires resolving every observed symptom linked to each likely disease. EX1009, 3:52-54, 4:45-52; EX1003 ¶487.

e. Element [32d]

Zhong’s symptom nodes link to disease nodes, and “an edge that links a symptom node to a disease node has an associated symptom-disease pair value that represents a probability.” EX1009, claim 1. Zhong describes a node as an “entity, such as a symptom,” and places the condition-specific probability on the edge, not the node; because each symptom node links to multiple diseases through separate edges, the node carries no condition-specific information. *Id.*, 3:20-25, 4:48-52.



EX1009 FIG. 2

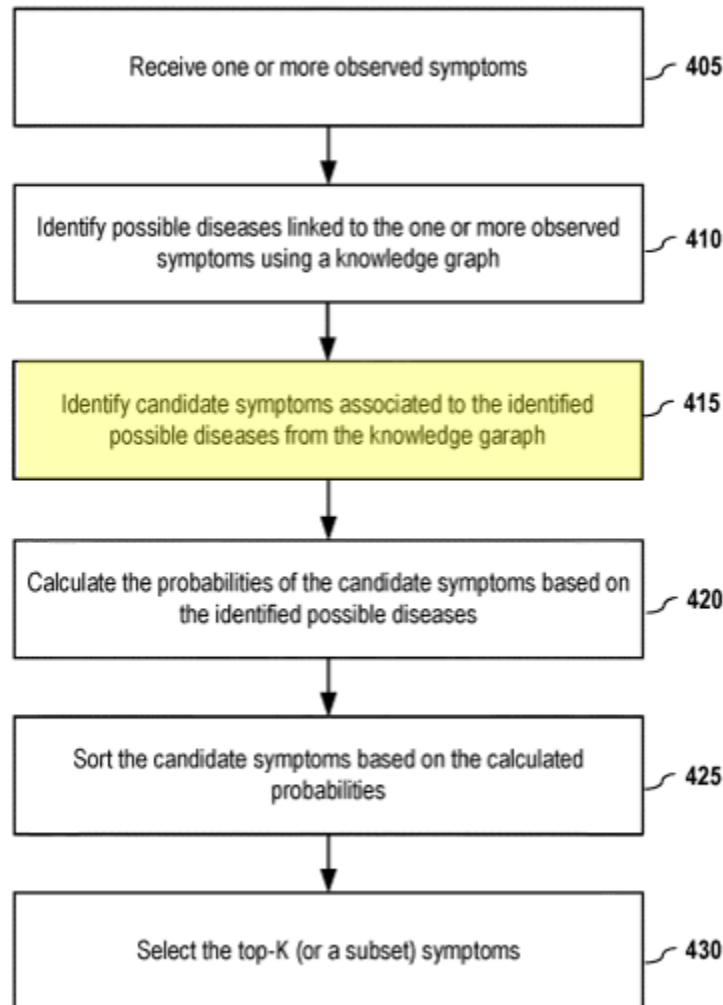
Because one symptom node serves many diseases through separate edges, the edge is the logical place for the condition-specific value. EX1003 ¶494.

To the extent Zhong is not explicit, Datla's condition-independent nodes supply this limitation for the reasons above. *Supra* §VIII.I.1; EX1005 ¶¶[0031]-[0032]; EX1003 ¶¶490-494, 461.

f. Element [32e]

At step 415, Zhong identifies “candidate symptoms (Sc) associated with the likely diseases ... using the knowledge graph,” and “a candidate symptom may be an unobserved symptom or a symptom not reported to the automatic diagnosis system,” i.e., a factor not known to be present or absent. EX1009, 3:52-54, 4:46-49. An unobserved, unreported symptom is one whose diagnostic status has not been established. EX1003 ¶497.

Zhong also removes any candidate that conflicts with observed symptoms. *Id.*, 4:14-19. Because candidates are found by traversing from the likely diseases, each is linked to that disease: “[e]ach candidate symptom may be associate[d] to one or more possible diseases.” *Id.*, 4:48-52; EX1003 ¶¶495-499.



EX1009 FIG. 4 (annotated)

g. Element [32f]

Element [32f] combines [21e]-[21g], applied to “known and unknown” factor entries; that difference does not affect the analysis. *Supra* §§VIII.F.2.f-h. Zhong does

not state where its entries originate, but in the combination Zhong's graph is built with Datla's journal-based techniques and includes MacRae. *Supra* §VIII.I.1; EX1005 ¶¶[0030]-[0031], [0034]; EX1009, 3:25-29. Datla processes journal articles in PubMed and extracts diagnostic factors from that text through "topical keyword analysis" and "diagnostic inference." EX1005 ¶¶[0033]-[0034], [0047]-[0048]; EX1003 ¶¶503-504. Datla describes fever as "a symptom of many patient scenarios," i.e., a factor discussed as indicative of conditions. EX1005 ¶[0031]; EX1003 ¶505.

For the different taxonomy language, Petitioner applies Patent Owner's reading of MacRae, as discussed in Ground 6. *Supra* §§VIII.E, VIII.F.2.g; EX1019, 88-91; EX1003 ¶¶500-508.

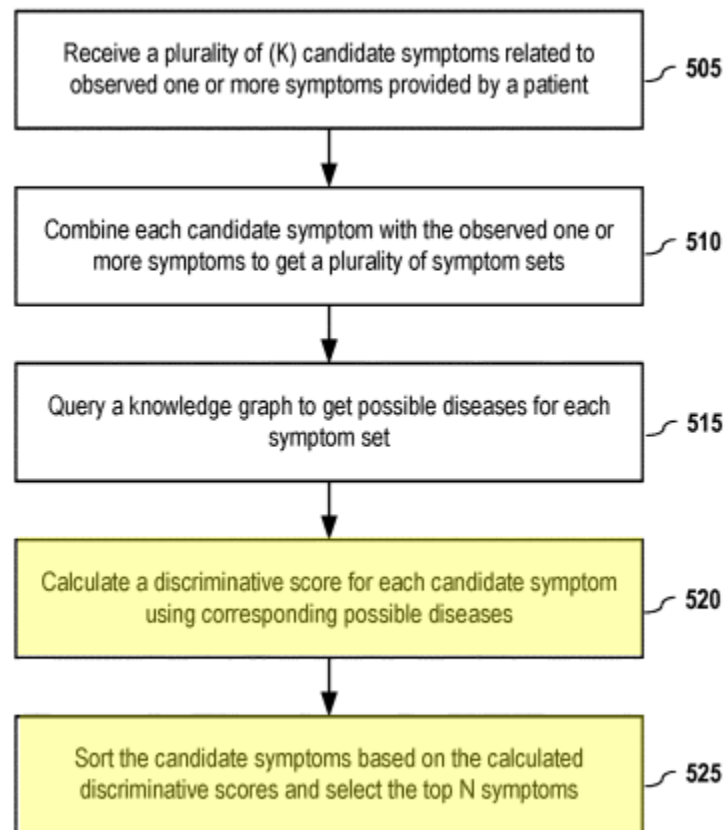
h. Element [32g]

Element [32g] is substantively the same as [1h], [15g], and [21h], except that the APIs access the known and unknown factor entries linked to the condition entry. Gnanasambandam's APIs, applied to the combined graph for the reasons above, provide that access so an application can generate the healthcare determination. *Supra* §§VIII.A.2.i, VIII.D.2.h, VIII.F.2.i, VIII.I.1; EX1007, 1:34-39, 100:24-38, 102:36-42, FIGS. 91-92; EX1003 ¶¶509-516. Zhong's remote, network-accessible, modular design is the type of system for which APIs are the standard deployment mechanism, allowing EHR and other clinical applications to submit observed

symptoms and receive the generated questions. EX1009, 2:61-63, 3:14-17, 7:35-40; EX1003 ¶¶515-516.

i. Element [32h]

Zhong ranks the unknown factors in two stages. Zhong calculates each candidate's probability "based on the likely disease" and sorts the candidates, then calculates "a discriminative (or discriminability) score ... for each candidate symptom using corresponding possible diseases" and sorts again to select the top N. EX1009, 4:52-66, 5:33-38, 5:55-58, FIGS. 4-5. The rank is stored on the link: Zhong's symptom-disease pair value on each edge represents the probability linking that symptom and disease, and Zhong's scoring uses those edge values. Id., claim 1; EX1003 ¶¶517-522.



EX1009 FIG. 5 (annotated)

Zhong's step-420 probability and step-520 discriminative score are each inferred from the edge-stored pair values, so the rank of each unknown factor derives from the value stored in the link. EX1009, 4:52-61, 5:33-42, claim 1; EX1003 ¶522.

j. Element [32i]

Zhong generates questions "based on the selected candidate symptoms without conflicts" and sends them "via an output interface 130 to obtain more relevant information for more accurate diagnosis." EX1009, 2:64-67, 6:13-30. Output interface 130 presents those questions, including questions about related

dimensional information. EX1009, 6:13-19; EX1003 ¶¶524-525. The questions are displayed “in association with” each condition because each candidate is identified from, and scored against, the above-threshold diseases. EX1009, 4:46-52, 5:34-36. To the extent the claim requires showing the condition alongside the factors, doing so would have been obvious: Zhong already maintains the association, and labeling which suspected condition each question relates to helps the clinician understand the reasoning in a differential diagnosis. EX1003 ¶¶523-532.

The factors are displayed “in order of said rank.” The ’882 patent lists unknown factors “in order of their likelihood ... with or without an explicit ranking.” EX1001, 30:25-28. Zhong’s sort-select-output sequence preserves rank order, and its conflict check removes candidates without reordering them. EX1009, 4:64-66, 5:55-58, 6:13-30. Even if an express ranked display were required, presenting already-sorted results in rank order was a ubiquitous convention that lets the clinician prioritize the most informative question and would have been obvious to a POSITA. EX1003 ¶¶533-541.

The display is the “healthcare determination.” The ’882 patent describes its output as including “unknown factors that should be queried,” and next-best actions as “a question to ask the patient about a specific diagnostic or risk factor.” EX1001, 9:7-17. Zhong’s ranked questions are at least a recommendation and a result. EX1003 ¶¶542-543.

3. Claim 33

Zhong traverses from the likely disease nodes to linked symptom nodes, defines candidates as unobserved or unreported symptoms, and removes candidates that conflict with observed symptoms-traversing down from each condition entry while disregarding the known factor entries. EX1009, 3:52-54, 4:14-18, 4:45-52; EX1003 ¶¶544-546.

4. Claim 38

Each Zhong edge carries its own symptom-disease pair value, and one symptom node links to multiple diseases. EX1009, 4:48-52, claim 1. Traversing from one unknown factor to two diseases thus follows two edges with different values and produces different ranks, as in the '882 patent's fever example. EX1001, 25:12-14; EX1003 ¶¶547-549.

5. Claim 39

The claim 12 and 29 analysis applies to claim 39, which differs only in its parent. The combined graph is built with Datla's techniques from a clinical-medicine corpus, and Zhong's graph holds the same entity types, "a symptom, a dimension, a demographic, and a disease," so adding more is routine scaling. *Supra* §§VIII.A.8, VIII.F.7; EX1009, 3:20-25; EX1003 ¶¶550-551.

6. Claim 40

The claim 13 and 30 analysis applies to claim 40, which differs only in its parent. *Supra* §§VIII.A.9, VIII.F.8. The '882 patent ties no benefit to the threshold

and acknowledges that “an actual graph database will be much more complex and contain many hundreds of thousands of nodes or more.” EX1001, 27:67-28:3; EX1003 ¶¶552-553.

7. Claim 41

As explained for [32i], Zhong’s ranked questions are at least a recommendation and a result. *Supra* §VIII.I.2.j; EX1003 ¶¶554-555.

J. Ground 10: Claim 34 is Unpatentable Over Zhong, Datla, Gnanasambandam, MacRae, and Dang

Claim 34 would have been obvious over Zhong, Datla, Gnanasambandam, MacRae, and Dang. EX1003 ¶¶556-570. In the combination, Dang supplies intermediate feature nodes holding disease-specific values. *Id.* ¶556.

Claim 34 would have been obvious over the Ground 9 combination in view of Dang. *Supra* §VIII.I.1; EX1003 ¶¶556-557. Like Zhong, Dang uses a symptom-disease knowledge graph to evaluate disease likelihoods and “[g]enerate a best next inquiry question,” and both attach conditional probabilities to disease-finding relationships. EX1008, Abstract, ¶[0031]; EX1009, Abstract, claim 1; EX1003 ¶¶558-559. Zhong already includes “dimension” and “demographic” nodes, so its graph readily accommodates Dang’s node types. EX1009, 3:20-38; EX1003 ¶560.

Dang’s graph has factual, feature, and disease nodes, with symptom nodes connecting to feature nodes, and feature nodes connecting to disease nodes. EX1008 ¶¶[0028]-[0032], FIG. 1B; EX1003 ¶562. A feature node groups factual nodes (e.g.,

s1, s2, and c1) for a disease and is thus a “factor group entry” located between the condition and factor entries, as in the ’882 patent. EX1001, 20:60-21:8; EX1003 ¶563. For the reasons given for claim 16, it would have been obvious to hold P(f|d), the rank of the linked factors for that disease, within the disease-specific feature node, which changes neither the value’s meaning nor its use. *Supra* §VIII.D.3; EX1003 ¶564.

A POSITA would have made this modification for four reasons. First, Dang’s feature-level scoring gives Zhong’s discriminative score, “the maximized probability gap between top likely diseases and unlikely diseases,” a disease-by-disease view of which findings separate diseases. EX1009, 5:35-38; EX1008 ¶¶[0049]-[0050]; EX1003 ¶566. Second, Zhong already represents symptom context, and Dang’s feature nodes group symptom and context nodes. EX1009, 3:20-25, 6:8-12; EX1008, FIG. 1B; EX1003 ¶567. Third, holding the rank in an intermediate entry keeps each symptom node condition-independent. *Supra* §VIII.I.2.e; EX1003 ¶568. Fourth, holding a value on an edge or in an intermediate node was a routine design choice. EX1003 ¶569. A POSITA would have reasonably expected success because Zhong would simply read the value from the feature node. EX1009, claim 1; EX1008 ¶¶[0049]-[0050]; EX1003 ¶570.

K. Ground 11: Claims 35-36 are Unpatentable Over Zhong, Datla, Gnanasambandam, MacRae, and Kim

Claims 35-36 would have been obvious over Zhong, Datla, Gnanasambandam, MacRae, and Kim. EX1003 ¶¶571-579.

A POSITA would have combined Zhong, Datla, Gnanasambandam, and MacRae as discussed for Ground 9, and would have added Kim for the reasons given for Grounds 2 and 7, which apply equally with Zhong as the primary reference. *Supra* §§VIII.B.1, VIII.G, VIII.I.1; EX1003 ¶572. Zhong's graph is updated from "various medical database or websites." EX1009, 3:25-29. A graph drawn from multiple sources benefits from Kim's identifiers and synonyms, which (i) let the same concept be recognized regardless of how a source describes it and (ii) prevent redundant concepts. EX1012 ¶¶[0050], [0054]; EX1003 ¶572.

1. Claim 35

As discussed for claims 4 and 23, it would have been obvious to include in each diagnostic factor entry a unique ontology identifier, as Kim teaches, i.e., a "medical ontology link found in said identified known diagnostic factor entry." *Supra* §§VIII.B.2, VIII.G.1; EX1012 ¶¶[0041], [0051]; EX1003 ¶574. Zhong's known factors are its observed symptoms, stored in the same symptom nodes as every other symptom. *Supra* §VIII.I.2.d; EX1003 ¶574.

Kim teaches that "[o]nce an ontology code (unique identifier) has been assigned ... related concepts as represented in the graph database can be suggested,"

and Datla adds edges “according to a hierarchical relation of the corpus of medical information.” EX1012 ¶[0052]; EX1005, claim 16; EX1003 ¶575. Zhong identifies likely diseases by running a graph inference algorithm over the observed symptoms, and repeats it as the observed symptoms are updated. EX1009, 4:27-31, 4:38-44; EX1003 ¶576. In a graph holding the ontology’s parent-child edges, the inference propagates along every connected edge, including from a known finding up to its parent (e.g., a patient known to have bacterial pneumonia is thereby inferred to have pneumonia). EX1003 ¶576. That is traversing upward in the ontology link “in order to infer other known diagnostic factors present in said patient.” *Id.*

Even if not automatic, the step would have been obvious. Inferring parent findings captures disease associations recorded at a more general level and keeps an already-known finding from being asked about as a candidate. *Supra* §VIII.I.3; EX1003 ¶577. Following a stored hierarchical link is routine and leaves Zhong’s scoring and question generation unchanged. EX1003 ¶577.

2. Claim 36

Claim 36 is substantively the same as claim 24 but requires synonyms in both the known and unknown entries. As discussed for claims 5 and 24, it would have been obvious to include at least one synonym in each diagnostic factor entry, as Kim teaches: “the graph database includes synonyms, translations, concepts and relationships.” *Supra* §§VIII.B.3, VIII.G.2; EX1012 ¶[0054]; EX1003 ¶579. In

Zhong, a symptom is “known” or “unknown” only relative to a particular patient, and both are stored in the same symptom nodes, so adding synonyms to each symptom node adds them to both. *Supra* §§VIII.I.2.d, VIII.I.2.f; EX1003 ¶579. Synonyms also help Zhong identify unknown factors: a candidate whose synonym already appears among the observed symptoms is recognized as known and is not asked about. EX1009, 3:52-54; EX1003 ¶579.

L. Ground 12: Claim 37 is Unpatentable Over Zhong, Datla, Gnanasambandam, MacRae, and Van Assel

Claim 37 would have been obvious over Zhong, Datla, Gnanasambandam, MacRae, and Van Assel. EX1003 ¶¶580-586.

A POSITA would have combined Zhong, Datla, Gnanasambandam, and MacRae as discussed for Ground 9, and would have added Van Assel’s present/absent attribute for the reasons given for Ground 8. *Supra* §§VIII.H, VIII.I.1; EX1003 ¶581. Like Zhong, Van Assel performs knowledge-graph-based diagnosis, and Zhong already tracks each symptom’s status as observed or not observed. EX1011 ¶¶[0113], [0115]; EX1009, 3:41-44, 3:52-54; EX1003 ¶581.

Claim 37 is substantively the same as claims 6 and 25 but covers both known and unknown entries. *Supra* §§VIII.C, VIII.H; EX1003 ¶583. Zhong’s known factors are observed symptoms, including symptoms the patient denies; its unknown factors are candidates that are “unobserved” or “not reported.” *Supra* §VIII.I.2.d; EX1009, 3:52-54; EX1003 ¶584. Datla likewise determines whether an extracted

concept is negated. EX1005 ¶¶0054]; EX1003 ¶584. Van Assel “assigns 1, -1, or 0 to the extracted concept to indicate whether the concept is validly present (1), validly absent (-1) or this is unknown (0).” EX1011 ¶¶0245]. In the combination, each known entry carries 1 or -1 and each unknown entry carries 0, so every known and unknown entry includes a negation attribute indicating whether the factor is present or not. EX1001, 21:31-32; EX1003 ¶585.

The stored value also simplifies two operations Zhong already performs, defining candidates as the complement of the observed set and removing candidates that conflict with observed symptoms, by reducing each to a check of the attribute. EX1009, 3:52-54, 4:14-18; EX1003 ¶586. Storing a ternary value as a node property is routine and leaves Zhong’s inference, scoring, and question generation unchanged, so a POSITA would have reasonably expected success. EX1003 ¶586.

M. Ground 13: Claims 1-9 and 11-41 are Unpatentable Under 35 U.S.C. § 101

The challenged claims are unpatentable under 35 U.S.C. § 101 because they are directed to ineligible subject matter. EX1003 ¶¶587-651. The challenged claims are directed to the abstract idea of collecting, organizing, storing, and providing access to medical data. *Id.* ¶¶589-626. The claims implement the abstract idea with conventional computer components and well-known techniques and add no inventive concept. *Id.* ¶¶627-650.

1. Legal Standard

Abstract ideas are not patentable. *Alice Corp. Pty. v. CLS Bank Int'l*, 573 U.S. 208, 216-18 (2014). Under *Alice*, the Board first determines what the claim is “directed to.” *Id.* at 219. If the claim is directed to an abstract idea, the Board examines the claim elements, individually and as an ordered combination, for an “inventive concept” sufficient to transform the abstract idea into a patent-eligible application. *Id.* at 217-18, 221. “[M]erely requir[ing] generic computer implementation[] fail[s] to transform that abstract idea into a patent-eligible invention.” *Id.* at 221.

The Board applies this framework through the Office’s eligibility guidance. *Nabors Drilling Techs. USA, Inc. v. Motive Drilling Techs., Inc.*, PGR2022-00055, Paper 27 at 17-18 (PTAB Feb. 22, 2024). Under Step 2A, Prong One, the Board asks whether the claim recites a judicial exception, such as a mental process. Under Prong Two, the Board identifies the elements recited beyond the exception and asks whether they integrate the exception into a practical application. If they do not, Step 2B asks whether those additional elements are more than well-understood, routine, and conventional activity.

2. Independent Claim 1

Claim 1 recites a computer system and therefore falls within a statutory category at Step 1.

a. Step 2A, Prong One

Claim 1 recites a mental process: collecting medical evidence from published sources, identifying the diagnostic factors associated with each condition, organizing those relationships as linked entries, and making them available for use. EX1003 ¶¶593, 595. These steps collect and manipulate information, which the Federal Circuit has repeatedly held abstract. *Content Extraction & Transmission LLC v. Wells Fargo Bank, N.A.*, 776 F.3d 1343, 1347 (Fed. Cir. 2014); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1353-54 (Fed. Cir. 2016); *In re Killian*, 45 F.4th 1373, 1380 (Fed. Cir. 2022). Limiting the information to medical conditions and diagnostic factors does not make the idea less abstract. *Elec. Power Grp.*, 830 F.3d at 1353; *Univ. of Fla. Rsch. Found., Inc. v. Gen. Elec. Co.*, 916 F.3d 1363, 1367 (Fed. Cir. 2019).

Clinicians and informaticists have long performed these activities by reading the literature, recording each finding's association with conditions in structured references, and keeping each finding as a reusable concept linked to many conditions. EX1003 ¶596; *supra* §§IV.A-IV.C. The specification frames the

problem the same way, acknowledging that publishers already “assemble the published evidence” into diagnostic content. EX1001, 1:58-2:5; EX1003 ¶595.

The Examiner agreed, finding that the original claims recited steps that “can be practically performed by a human, either mentally or with the use of pen and paper.” EX1002, 94-95; EX1003 ¶614; *PersonalWeb Techs. LLC v. Google LLC*, 8 F.4th 1310, 1316 (Fed. Cir. 2021) (Steps that “can be performed in the human mind” or “using a pencil and paper” represent “a telltale sign of abstraction.”).

b. Step 2A, Prong Two

The additional elements—processors, memory, a graph database, and APIs—do not integrate the abstract idea into a practical application. The processors and memory are generic components described in conventional terms. EX1001, 31:65-32:14, FIGS. 11A-11B; EX1003 ¶594. The graph database specifies no particular way of storing, indexing, or retrieving entries, and the specification permits “[a]ny of a wide variety of other types of databases.” EX1001, 8:10-18; EX1003 ¶597.

Nor do the claimed data arrangements improve computer functionality, contrary to Patent Owner’s assertion during prosecution. EX1002, 68. Keeping a node free of condition-specific information, adding a demographics node, and storing weights or ranks on links each decides only where medical information is recorded. None of these features make the database faster, smaller, or more reliable. EX1003 ¶¶608-612; EX1005 ¶¶[0031]-[0032]; EX1008 ¶[0027]; EX1009, 3:20-25,

claim 1. An improvement to the information stored in a database is not an improvement to the database's functionality. *BSG Tech LLC v. BuySeasons, Inc.*, 899 F.3d 1281, 1290-91 (Fed. Cir. 2018).

The claims recite the API only by function, and the specification identifies only off-the-shelf APIs. EX1001, 6:4-8; EX1003 ¶616. Exchanging data through such an interface is a mere instruction to apply the exception using a generic computer component. *See VeriPath, Inc. v. Didomi*, 842 F. App'x 640, 643 (Fed. Cir. 2021) (claims that "utilize[] an API to achieve the desired result" were abstract). The requirement that the APIs provide access "to generate a healthcare determination" states only the intended use and is insignificant post-solution activity. EX1003 ¶636. Claim 1 thus merely uses a computer to collect, organize, and provide data. EX1003 ¶¶608, 612.

The applicant argued that "an API [is] a software construct that a human cannot practically perform in his or her mind" to overcome § 101 during prosecution. EX1002, 68-69. That rationale is legally wrong: the question is whether the claim as a whole is directed to an abstract idea, not whether a human can literally execute an API. EX1003 ¶617; *Oasis Tooling, Inc. v. Siemens Indus. Software Inc.*, No. 2024-2085, 2026 WL 537372, at *2 (Fed. Cir. Feb. 26, 2026) ("[i]t is immaterial to the patent eligibility analysis that human minds are unable to parse, standardize, and digest the data like a computer"); *Content Extraction*, 776 F.3d at 1347. The API

only makes the result of a long-performed process available to other software. EX1003 ¶¶617. Claim 1 is therefore directed to an abstract idea.

c. Step 2B

The additional elements, individually and as an ordered combination, are well-understood, routine, and conventional. EX1003 ¶¶627-642. Elements that are part of the abstract idea, including the taxonomy linkage, condition-independent entries, and graph traversal, which are aspects of collecting, organizing, and analyzing information, cannot supply an inventive concept. *BSG Tech*, 899 F.3d at 1290-91.

API. Exposing a medical knowledge base through APIs was well-established. BioPortal provided RESTful APIs for querying biomedical ontologies, including SNOMED-CT and LOINC, beginning in 2006; the National Library of Medicine’s UMLS provided API-based terminology services; and HL7’s FHIR standard included terminology-service APIs. EX1003 ¶¶88-89, 633. Gnanasambandam likewise publishes APIs that perform analytics based on a knowledge graph for client applications. EX1007, 100:24-34, 101:12-37; EX1003 ¶¶633. The ‘882 patent identifies only off-the-shelf FHIR, USCDI, CDS Hooks, and vendor-specific APIs. EX1001, 6:4-8. An API is no different from the generic “interactive interface” held insufficient in *Intellectual Ventures I LLC v. Capital One Bank (USA)*, 792 F.3d 1363, 1367, 1369-70 (Fed. Cir. 2015).

Graph database and data arrangements. Medical knowledge graphs with condition and diagnostic-factor nodes were well established. Datla discloses a graph of symptom and condition nodes connected by weighted edges in a system that includes a database. EX1005 ¶¶[0031], [0078]; EX1003 ¶628. Zhong likewise discloses a knowledge graph in which each node is an entity, such as a symptom, demographic, or disease. EX1009, 3:20-25. The ‘882 patent claims no new database type or storage or retrieval technique. EX1001, 8:10-18. Its condition-independent entries, demographics nodes, and weights or ranks on links are conventional data arrangements that merely record where information is kept. EX1003 ¶¶629-630.

Medical evidence sources and ontologies. Journals and other medical publications were conventional evidence sources, and practitioners routinely built knowledge graphs from them. Datla builds its graph from “any source of information, including but not limited to medical journals.” EX1005 ¶[0030]; EX1003 ¶631. The claimed taxonomies and hierarchies are supplied by pre-existing ontologies such as SNOMED-CT and LOINC. The specification acknowledges that multiple clinical ontologies exist and that SNOMED-CT provides taxonomies of clinical terms. EX1001, 4:13-20; EX1003 ¶632. Incorporating existing sources and ontologies does not provide an inventive concept.

Matching, weighting, thresholds, ranking, and display. These are conventional clinical-decision-support operations. Datla assigns activation weights

to extracted symptoms and queries its graph. EX1005 ¶[0055]. Dang matches input to graph nodes using semantic analysis and calculates confidence values. EX1008 ¶¶[0047]-[0050]. Zhong uses graph probabilities, thresholds, ranking, and question generation. EX1009, 3:39-6:30. Displaying the resulting conditions or factors is generic output functionality. EX1003 ¶¶634-635.

Output. Returning ranked conditions or next-best actions to an application through an API is not a technical improvement and specifies no mechanism for achieving the result. EX1003 ¶636. Claims that do “not even require a new source of information, or new techniques for analyzing it” lack an inventive concept. *Elec. Power Grp.*, 830 F.3d at 1355.

Ordered combination. Claim 1 receives medical evidence text, extracts diagnostic factors, stores factors and conditions as linked entries in a graph database, and makes the entries available through an API. Datla discloses constructing a medical knowledge graph, and Gnanasambandam discloses publishing APIs for a medical knowledge graph. *Supra* §§VIII.A, VIII.D; EX1003 ¶638. The ordered combination is a conventional arrangement of conventional components, each performing its ordinary function. It is “no more than the sum of [its] parts.” *Nabors*, Paper 27 at 30-31; EX1003 ¶¶637-638. The Examiner’s reasons for allowance rest on the API combined with the claimed data arrangement, both of which were conventional. EX1002, 17-20; EX1003 ¶642. Claims requiring nothing more than

conventional, generic technology to gather, analyze, and transmit data lack an inventive concept. *Elec. Power Grp.*, 830 F.3d at 1356.

Any purported gain in speed or efficiency from automating the collection, organization, or reporting of information is insufficient to confer eligibility. *Intellectual Ventures*, 792 F.3d at 1367; *Recentive Analytics, Inc. v. Fox Corp.*, 134 F.4th 1205, 1214-15 (Fed. Cir. 2025). Claim 1 therefore lacks an inventive concept.

3. Independent Claims 15, 21, and 32

Claims 15, 21, and 32 share claim 1's core features and add only limitations that further describe the abstract idea. EX1003 ¶¶588-589.

Claim 15. Claim 15 shares claim 1's core features: medical evidence sources, a cross-linked graph database, condition-independent diagnostic-factor entries, and APIs. It adds a demographics node between a condition and a factor and matches patient chart data to those nodes to display a healthcare determination. Those limitations describe the clinician's comparison of patient findings and demographics with stored knowledge to report a likely diagnosis, add no technological improvement, and are directed to the same abstract idea. The ordered combination is the conventional flow of building a graph, matching patient data, and reporting a likely condition. EX1003 ¶¶598-601, 639.

Claim 21. Claim 21 shares claim 1's cross-linked graph, condition-independent entries, and API. It adds receiving EHR data, matching known or absent

diagnostic factors, traversing links to collect weights, summing those weights for each condition, and displaying conditions in order of total weight, the same tallying and ranking a clinician performs when reviewing a chart. The summing is basic arithmetic, and the journal-source and taxonomy limitations specify only information content and source. Claim 21 is directed to the same abstract idea, and its ordered combination of conventional operations adds no inventive concept. EX1003 ¶¶602-604, 640.

Claim 32. Claim 32 shares claim 1's linked entries, condition-independent factors, and APIs, and adds applying a probability threshold, identifying known and unknown factors, ranking the unknown factors by a value stored in a link, and displaying them in order. These steps describe the ordinary next step in differential diagnosis: identifying findings not yet elicited and deciding which to ask about first. Applying a threshold, ranking questions, and displaying them is analysis and reporting, not a technical improvement. Claim 32 is directed to the same abstract idea, and its ordered combination of conventional components adds no inventive concept. EX1003 ¶¶605-607, 641.

4. Dependent Claims

Display and presentation (claims 2, 22, 28). Displaying a portion of the graph, a condition's total weight, or a display for diagnosis, administration, or preauthorization specifies what information is reported and why. It is part of

reporting the result of the abstract idea and is generic output functionality, not a practical application or inventive concept. EX1003 ¶¶619, 644.

Organization of entries (claims 3, 7, 8, 9, 11, 16, 27, 34, 38). These claims specify that entries are nodes, that factors or laboratory tests can be shared across conditions, that ranks or other condition-specific information can be stored on links or intermediate entries, and that a demographics match can gate traversal. They describe the categories of information and where condition-specific values are recorded. Datla, Dang, and Zhong disclose the same conventional data-placement choices. EX1003 ¶¶620, 629-630, 645.

Ontology identifiers and hierarchy traversal (claims 4, 23, 35). Annotating entries with ontology identifiers and traversing upward or downward through a medical hierarchy are standard ways to navigate SNOMED-CT and similar terminologies. Kim teaches unique ontology codes, and the specification attributes the hierarchy to existing ontologies. These limitations add no new traversal technique. EX1003 ¶¶621, 646.

Synonyms (claims 5, 24, 36). Storing synonyms in a graph entry is routine vocabulary management. Kim teaches that a graph database can include synonyms, translations, concepts, and relationships, and the '882 Patent attributes no technical function to synonyms beyond recognizing a concept across differently worded sources. EX1012 ¶[0054]; EX1001, 10:66-11:3; EX1003 ¶¶622, 647.

Presence, negation, and temporality (claims 6, 25, 37). Storing a present, absent, unknown, negated, or temporal value as a node or entry attribute is routine. Van Assel assigns 1, -1, or 0 to indicate valid presence, valid absence, or unknown status. EX1011 ¶¶0245]; EX1003 ¶¶623, 648. The claims add no mechanism for using those attributes beyond organizing and analyzing medical information.

NLP (claims 17, 26). Natural-language processing for extracting clinical concepts and matching them to graph entries was conventional. Datla discloses an NLP engine that extracts symptoms and queries a knowledge graph, and the ‘882 Patent describes initializing the NLP engine with graph nodes only as a preference, without a particular implementation. EX1005, claim 1; EX1001, 12:15-17, 23:7-10; EX1003 ¶¶624, 649.

Identification of unknown factors (claim 33). Identifying unknown diagnostic-factor entries by traversing down from a condition and disregarding known entries is the ordinary complement of the known set. Zhong discloses identifying unobserved candidate symptoms associated with likely diseases and excluding conflicts with observed symptoms. EX1009, 3:52-54, 4:45-52; EX1003 ¶¶625, 649.

Graph size and form of determination (claims 12-14, 18-20, 29-31, 39-41). The node-count thresholds specify only the scale of stored data; the ‘882 patent attaches no technical significance to them and states that an actual graph may contain

many hundreds of thousands of nodes or more. EX1001, 27:67-28:3; EX1003 ¶626. A database with 100,000 entries is directed to the same abstract idea as one with 100 entries. *Intellectual Ventures*, 792 F.3d at 1367. Labeling the output a recommendation, evaluation, result, or conclusion likewise adds no technical mechanism. EX1003 ¶¶626, 650.

No dependent claim, individually or as an ordered combination, adds an inventive concept. EX1003 ¶¶643, 651.

IX. CONCLUSION

For at least the foregoing reasons, the challenged claims are unpatentable.

Respectfully submitted,

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CERTIFICATION OF WORD COUNT

Pursuant to 37 C.F.R. § 42.24(d), the undersigned hereby certifies that the foregoing Petition for Post Grant Review is produced using a 14-point Times New Roman font and contains approximately 18,574 words, which is less than the 18,700 total words permitted by the U.S. Patent Trial and Appeal Board rules. Counsel relies on the word count of the computer program used to prepare the Petition on October 5, 2026.

Dated: October 5, 2026

By: /s/ Angelo Christopher

Lead Counsel for Petitioner

CERTIFICATE OF SERVICE

The undersigned hereby certifies that a copy of the foregoing Petition for Post Grant Review, together with all exhibits filed therewith, was served on October 5, 2026, by Federal Express at the correspondence address of record for the '882 Patent in the USPTO Patent Center:

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