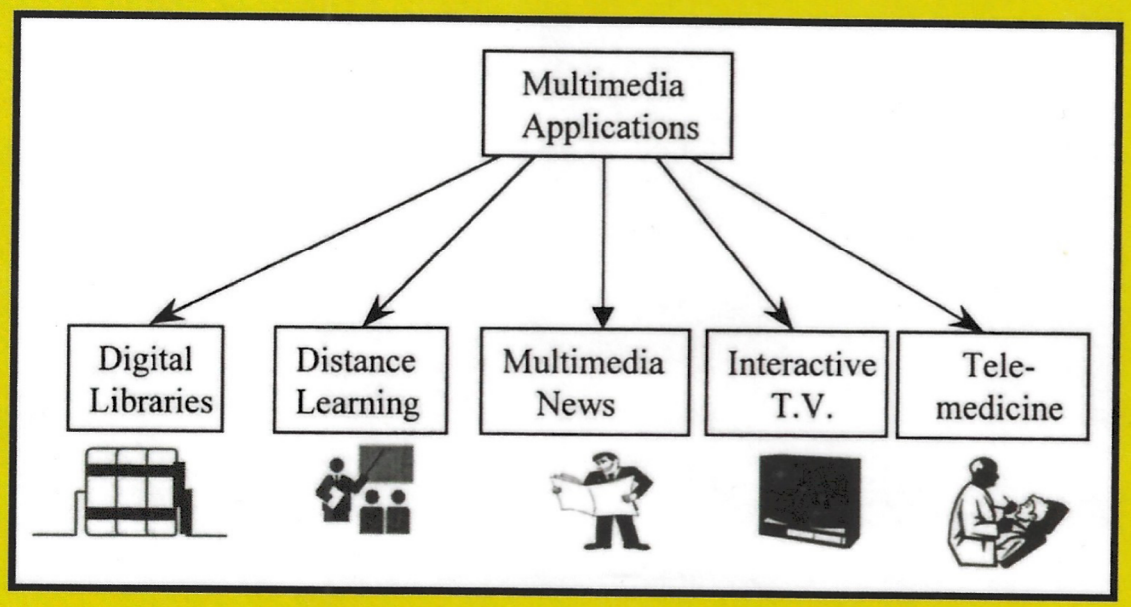
MX 0777717 5

MULTIMEDIA SIGNALS AND SYSTEMS

Mrinal Kr. Mandal



Extra Materials
extras.springer.com

KLUWER ACADEMIC PUBLISHERS
Boston/Dordrecht/London

MX 0777717 5

The Sheppard Library
Middlesex University
The Burroughs
London
NW4 4BT
020 8411 5852
http://library.mdx.ac.uk

Middlesex University

This book is due for return or renewal by the date stamped below. Fines will be charged for overdue items.

SEVEN DAY LOAN ONLY

Lib/3

LF/24

MULTIMEDIA SIGNALS AND SYSTEMS

Mrinal Kr. Mandal
University of Alberta, Canada



KLUWER ACADEMIC PUBLISHERS
Boston / Dordrecht / London

MIDDLESEX UNIVERSITY LIBRARY

Distributors for North, Central and South America:
Kluwer Academic Publishers
101 Philip Drive
Assinippi Park
Norwell, Massachusetts 02061 USA
Telephone (781) 871-6600
Fax (781) 681-9045
E-Mail < kluwer@wkap.com>

Distributors for all other countries:
Kluwer Academic Publishers Group
Post Office Box 322
3300 AH Dordrecht, THE NETHERLANDS
Telephone 31 78 6576 000
Fax 31 78 6576 254
E-Mail < services@wkap.nl>


Electronic Services < http://www.wkap.nl>

Library of Congress Cataloging-in-Publication Data

Mandal, Mrinal Kr.
Multimedia Signals and Systems / Mrinal Kr. Mandal.
p.cm.—(The Kluwer international series in engineering and computer science; SECS 716)
Includes bibliographical references and index.

Additional material to this book can be downloaded from http://extra.springer.com

ISBN 1-4020-7270-8 (alk. paper)
1. Multimedia systems. 2. Signal processing—Digitial techniques. I. Title. II. Series.

QA76.575 .M3155 2002
006.7—dc21

2002034047

Copyright © 2003 by Kluwer Academic Publishers

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, mechanical, photo-copying, recording, or otherwise, without the prior written permission of the publisher, Kluwer Academic Publishers, 101 Philip Drive, Assinippi Park, Norwell, Massachusetts 02061.

Permission for books published in Europe: permissions@wkap.nl
Permissions for books published in the United States of America: permissions@wkap.com

MATLAB® is a registered trademark of the MathWorks, Inc.

Printed on acid-free paper.

Printed in the United States of America.

Site HE
MIDDLESEX UNIVERSITY LIBRARY
Accession No. 07777167
Class No. 006.7 MAN.
Special Collection ✓

Sharpening or highpass filtering can be performed in the frequency domain, as well as in the transform domain. Note that image blurring is the inverse process of sharpening, where the image is blurred by low pass filtering.

The impulse response of a few sharpening filters is as follows:

$$F_1 = \begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}, \quad F_2 = 2 * \begin{bmatrix} 0 & -1 & 0 \\ -1 & 4.5 & -1 \\ 0 & -1 & 0 \end{bmatrix}, \quad F_3 = 10 * \begin{bmatrix} 0 & -1 & 0 \\ -1 & 4.10 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

Note that the above filters are not strictly highpass filters. These filters can be decomposed into two components: an allpass filter and a highpass filter. For example, F_1 can be decomposed as

$$F_1 = \begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix} = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix} + \begin{bmatrix} 0 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 0 \end{bmatrix} \tag{11.8}$$

The first component outputs the original image, whereas the second component of the filter outputs a highpass image. Overall, a high frequency emphasized output is produced.

■ Example 11.5

A blurred Lena image is shown in Fig. 11.12(a). The image is passed through the three sharpening filters F_1, F_2, and F_3 as mentioned above. The sharpened images are shown in Figs. 11.12(b)-(d). It is observed that Fig. 11.12(d) has the most sharpened edges among the four images since its corresponding high frequency component is strongest. However, it also has maximum noise (the highpass filter also produces noise). Hence, there is a trade-off between the edge sharpening and the noise content. ■

11.3 DIGITAL VIDEO

Digital video is one of the most exciting media to work with, and there are numerous types of digital video processing techniques. The video compression techniques, which provide a high storage and transmission efficiency for various applications, were introduced in Chapter 9. In this section, we focus on the content manipulation in digital video.

A digital video is a sequence of frames that are still pictures at specific time instances. Consider a digital movie of 1-hour duration with a rate of 30 frames/sec. There would be 108000 frames. In order to perform a content-based search, the individual frames may be grouped into *scenes* and *shots*, as shown in Fig. 11.13. A *shot* is defined as a sequence of frames generated

during a continuous operation and representing a continuous action in time and space. A *scene* consists of one or more shots not necessarily contiguous in time. For example, it is possible to have two shots of the same scene, one in the morning and the other in the afternoon. Consider the video sequence shown in Fig. 9.2 (in Chapter 9). The video consists of three shots (and also three scenes), with the shots having 34, 38 (approximately), and 40 (approximately) frames, respectively.



Figure 11.12. Image sharpening performance of different filters. a) image to be sharpened, b) output image produced by the filter F_1, c) output image produced by the filter F_2, and d) output image produced by filter F_3.

Each shot in a video sequence consists of frames with different scenes. There are two ways by which two shots can be joined together – i) abrupt transition (AT), and ii) gradual transition (GT). In AT, two shots are simply

concatenated, while in the GT additional frames may be introduced using editing operations such as fade in, fade out or dissolve.

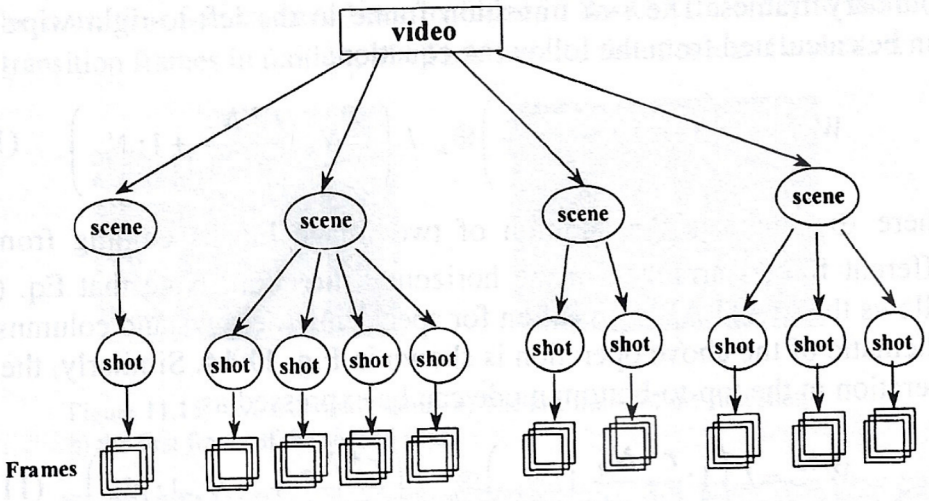


Figure 11.13. Video sequence can be grouped in terms of scenes and shots. In order to increase the granularity further, the frames can be divided into regions or objects as suggested by the MPEG-4 standard.

11.3.1 Special Effects and Gradual Transition

There is a wide variety of techniques for introducing special effects while combining two shots at the boundaries [5, 6] with gradual transition. These techniques can be primarily divided into three categories: wipe, dissolve, and fade.

In *wipe*, the images from one shot are replaced by the images from another shot, separated by a border that moves across or around the frame. There are different types of wipes depending on how the separated border is moved across the frame. In *dissolve*, the images of one shot are gradually replaced by the images of another using a weighted average of two boundary frames. In *fade*, a video shot is gradually converted to a black (or white) image, or a video frame is obtained gradually from a black (or white) frame. These three techniques are presented in more detail in the following sections.

11.3.1.1 Wipe

As mentioned above, the transition from the last frame (I_1) of the first shot to the first frame (I_2) of the second shot is obtained by a moving border as if somebody is wiping one frame and replacing it with another frame. Several wiping directions are possible such as left-to-right, right-to-left, and top-to-bottom. In left-to-right mode, the wiping starts at the left boundary of I_1, whereas in the right-to-left mode the wiping starts at the right boundary of I_1.