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Estimation Algorithms For
Video Compression The
**Motion Estimation
Algorithms For
Video Compression
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Estimation Algorithms For

In Engineering And Computer Science

*Video compression
technology aims at
compressing large amount
of video data for*

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*Video Compression. The
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Science.* Most video
compression techniques
rely on removing temporal
data redundancy between

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*frames using motion
estimation and motion
compensation techniques
which are generally very
computationally expensive.
The objective of the
research done in this*

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*thesis is to develop new
efficient motion
estimation techniques that
reduce the computational
complexity of motion
estimation. The thesis
presents a new prediction*

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*technique referred to as
weighted sum block
matching (WSBM) which
dynamically reduces the
computational complexity
by limiting the search to
a small subset of the*

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search area. Simulation results have shown that adding WSBM to some well-known search algorithms reduces their computational complexity by 6-1.5 without affecting

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Video Compression. The
the visual quality of the
reconstructed video
frames. The thesis also
presents two new
algorithms based on the
simplex optimization
method. the simplex based

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*block matching algorithm
(SMPLX) and the flexible
triangle search (FTS).*

*Both techniques use a
triangle that moves inside
the search area and checks
only positions that lie at*

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its vertices. As a result the computational complexity of the search is reduced since it depends directly on the number of positions checked. The techniques

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can change the size and orientation of the search triangle during the search. The changes make the search highly flexible and efficient and reduce the number of search

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*positions to be checked
compared to those in other
search algorithms. The
SMPLX uses equations based
on the simplex
optimization method to
compute the new triangle*

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*size and orientation. The
FTS, on the other hand,
was implemented to be more
suitable for a digital
search grid by using look-
up tables and integer
computations. The two*

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*algorithms were
implemented as part of the
H.263 and H.264 encoders.*

*Both algorithms were
compared to the state of
the a.*

Motion Estimation

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Science & Business Media
Efficient Motion-
estimation Algorithms for
Video Coding
Development of Fast Motion

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A Motion Estimation Tool

Encyclopedia of Multimedia

Fast Feature-based Motion

Estimation Algorithms

This second edition provides easy

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*access to important concepts, issues
and technology trends in the field
of multimedia technologies,
systems, techniques, and
applications. Over 1,100 heavily-
illustrated pages — including 80
new entries — present concise*

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*overviews of all aspects of software,
systems, web tools and hardware
that enable video, audio and
developing media to be shared and
delivered electronically.*

*The volume comprises of papers
presented at the first CADEC-2019*

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conference held at Vellore Institute

of Technology-Andhra Pradesh,

Amaravati, India. The book

contains computer simulated

results in various areas of

electronics and communication

engineering such as, VLSI and

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*embedded systems, wireless
communication, signal processing,
power electronics and control
theory applications. This volume*

*will help researchers and engineers
to develop and extend their ideas in
upcoming research in electronics*

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and communication.

*H.264 Motion Estimation and
Motion Compensation*

*Motion Estimation for Video
Coding*

*Fast Implementations of Block
Motion Estimation Algorithms in*

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Video Encoders

International Conference on

Intelligent Data Communication

Technologies and Internet of

Things (ICICI) 2018

A Complete Framework for the

Analysis, Design and

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Multimedia hardware still

cannot accommodate the

demand for large amounts of

visual data. Without the

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generation of high-quality video bitstreams, limited hardware capabilities will continue to stifle the advancement of multimedia technologies. Thorough grounding in coding is needed so that applications such as

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MPEG-4 and JPEG 2000 may
come to fruition. Image and
Video Compression for

Multimedia Engineering

provides a solid, comprehensive
understanding of the

fundamentals and algorithms

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that lead to the creation of new methods for generating high quality video bit streams. The authors present a number of relevant advances along with international standards. New to the Second Edition · A chapter

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describing the recently
developed video coding
standard, MPEG-Part 10
Advances Video Coding also
known as H.264 · Fundamental
concepts and algorithms of
JPEG2000 · Color systems of

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digital video · Up-to-date video coding standards and profiles Visual data, image, and video coding will continue to enable the creation of advanced hardware, suitable to the demands of new applications.

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Covering both image and video compression, this book yields a unique, self-contained reference for practitioners to build a basis for future study, research, and development.

Knowledge of motion fields is

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crucial to several applications such as video coding, image scene analysis and noise reduction. Estimation of this field is frequently done using constraints such as smoothness deduced from physical

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considerations of the process
generating the video.

Smoothness of motion is a
qualitative statement regarding
local relationships of elements
of this field. In this work, our
primary focus is on

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quantitatively modeling the relationships between elements of the motion field at spatial neighborhoods of pixels and in filtering of motion. These are accomplished by generalizing popular techniques in statistical

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signal

processing--autoregressive (AR)
models and moving average
(MA) filtering. First, we show an
equivalence between estimates
from AR models (output of MA
filtering) to the solution of a

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weighted least squares problem. This least squares problem is then generalized to enable modeling (filtering) of motion fields. Our AR model for motion is significantly different from previous approaches in that

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instead of computing motion at a pixel as a linear combination of motion at a spatial neighborhood of pixels, we compute the motion at a pixel using the observable data (i.e., pixel intensities) directly. An

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extension of this temporal AR
model to a joint spatiotemporal
model is also presented.

Applications to interframe
estimation reveal that
interframe prediction accuracy
is improved over previous

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methods by as much as 37%. A temporal MA filtering formulation is proposed and applied to preprocessing video prior to coding. Preprocessing results indicate that coding gains using MPEG1 of 20% may

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be obtained while maintaining the same level of visual quality of decoded pre-processed video as compared to the decoded original sequence. Extending the temporal filtering to a joint spatiotemporal filtering, we

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propose algorithms for noise
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reduction. At low and moderate
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signal to noise ratios, our
Science
algorithms perform reasonable
well, but worse than the best
results in the literature, while at
high SNR, they perform better.

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It is believed that with improved estimation of parameters used in the algorithms, performance may be improved. Aside from the above main focus, we also present investigations into two other issues: (1) Efficient motion

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estimation algorithms for overlapped block motion compensation--we present algorithms that can trade off computational complexity for prediction accuracy in an efficient manner and (2)

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Supports to be used in linear predictive models--algorithms are presented which compute supports yielding up to 37% improvements in prediction over nearest neighbor based supports.

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Evaluating motion estimation
algorithms for video
compression

Algorithms, Complexity Analysis
and VLSI Architectures for

MPEG-4 Motion Estimation

Motion Modeling and Video

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Video Compression The
Processing
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Fast Motion Estimation
Engineering And Computer
Algorithms for Block-Based
Science
Video Coding Encoders

Techniques and Algorithms

**Este trabalho teve por objetivo
estudar algoritmos de estimação**

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de movimento baseados na

técnica de casamento de bloco a

fim de avaliar a importância da

sua escolha na construção de um

codificador para uso em

compressão de seqüência de

imagens. Para isto foram

estudados quatro algoritmos

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baseados na técnica de casamento de bloco, sendo verificada a interdependência existente entre os vários parâmetros que os compõem, tais como, tamanho da área de busca, critérios de medida de distorção entre blocos e

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**tamanhos de blocos, em relação
à qualidade da imagem**

reconstruída.

The book deals with the

**development of a methodology to
estimate the motion field**

**between two frames for video
coding applications. This book**

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proposes an exhaustive study of the motion estimation process in the framework of a general video

coder. The conceptual

explanations are discussed in a simple language and with the use of suitable figures. The book will serve as a guide for new

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**researchers working in the field
of motion estimation techniques.**

A Low-complexity Approach for

Motion-compensated Video

Frame Rate Up-conversion

Proceeding of the First Annual

Conference on Computer-Aided

Developments in Electronics and

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**Communication (CADEC-2019),
Vellore Institute of Technology,**

Amaravati, India, 2-3 March 2019

Highly Efficient Motion

**Estimation Algorithms in Video
Coding**

Applications of Fast Low-

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**distortion Motion Estimation
Algorithms in Video Coding**

As technology advances,

multimedia applications

increase exponentially in

day-to-day life.

Multimedia applications

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such as video telephony,
video conferencing, TV,
streaming video/audio
online, and many other
applications are in demand
in video industry. These
applications usually

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require high bandwidth,
large storage, and high
latency time to send on
network. To conserve
resources, it is required
to compress the video data
before sending them to the

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network by sender side. It is also required to decompress the video data at receiver end before broadcasting. Many different video codec standards such as H.261,

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MPEG-1, MPEG-2, H.263, and
H.264 are implemented.

H.264 is latest

international video codec

standard. This protocol

was developed jointly by

International

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Telecommunication Union -
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Telecommunication
Standardization Sector
Engineering And Computer
(ITU-T) and International
Science
Organization for
Standardization (ISO). The
objective of this project

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is to explore different blocks of H.264 in MATLAB environment. This project first briefly describes about encoding and decoding process, and then it discusses more details

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The Springer International Series In Engineering And Computer Science about different modules of encoder and decoder, and the related algorithms.

Finally, it compares the result of different algorithms based on compression ratio, peak

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signal to noise ratio, time required for encoding process, and storage. A video file is given as input to encoder, the video file is converted to a number of frames using

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video codec, and fixed size macro block is defined in each frame for encoding process. Motion search algorithm finds motion vector after macro block definition, then

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compensated image is generated based on reference frame and motion vector by video codec.

Redundancy is removed from current frame by subtracting compensated

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image. Compression of residual information is performed using transformation, quantization, and entropy coder. Compressed data are given as inputs to

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decoder, and decoder process the image to reconstruct image. To enhance image quality and reduce blocking artifact, the image frame is passed through filter. The

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The project is completed successfully by reconstructing video with reasonable quality.

Motion estimation is a key issue in the field of moving images analysis. In

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the framework of video coding, it is combined with motion compensation in order to exploit the spatio temporal correlation of image sequences along the motion

trajectory. It then achieves one of the most important compression factors of a video coder. By dividing each frame into rectangular blocks, motion vectors are

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obtained via the block matching algorithms (BMA).

The full search algorithm (FS) is a brute force BMA.

It searches all possible locations inside the search window in the

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reference frame to provide an optimal solution.

However, its high computational complexity makes it often not suitable for real-time implementation. Many fast

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but sub-optimal algorithms are introduced to improve the performance of video coders. The present book analyses three prospects of improving the quality of existing video coding

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schemes. Namely, one at a time optimization, adaptive search stagey and feature domain based criteria.

Fast Motion Estimation Algorithms for Video

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Coding
New Motion Estimation
Techniques and Their SIMD
Implementations for Video
Coding
Block-based Motion
Estimation Algorithms for

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Video Coding Applications
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Efficient Block-matching
Engineering And Computer
Motion Estimation
Algorithms for Video
Coding
Motion Estimation
Techniques for Digital

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Video Coding

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This book discusses data communication and computer networking, communication technologies and the applications of IoT (Internet of Things), big data, cloud computing and

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healthcare informatics. It

explores, examines and critiques

intelligent data communications

and presents inventive

methodologies in communication

technologies and IoT. Aimed at

researchers and academicians

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**who need to understand the
importance of data
communication and advanced
technologies in IoT, it offers
different perspectives to help
readers increase their knowledge
and motivates them to conduct**

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Science
**research in the area, highlighting
various innovative ideas for future
research.**

**The work on this thesis then
contrives a number of fast
algorithms for motion estimation.
The adoption of motion vector**

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**composition (MV composition) for
a fast motion estimation scheme in
a low-delay hierarchical P-frame
structure is firstly proposed. It**

expedites the motion estimation

process for distant reference

frames in the hierarchical P

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structure. In addition, a vector selection algorithm is tailor-made with the proposed hierarchical P coding scheme to further improve the coding efficiency. Simulation results show that the proposed scheme can deliver a remarkable

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complexity savings and coding

efficiency improvement on coding

a frame in low temporal layers of

the hierarchical P structure. The

rest of this work proposes to

perform motion locus prediction

before motion estimation. By this

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motion locus prediction, a suitable search range can be adjusted adaptively for motion estimation.

Thanks to the rapid development of MVC and 3D videos, the state-of-the-art 3D coding framework provides multi-view plus depth

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video (MVD) in which the depth map is additional information to be encoded in the coded

bitstreams. Depth maps record the distances of various objects in the scene from a viewpoint. With the depth maps from MVD

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**sequences, we reveal the depth
variation and the spatial
correlation between blocks as well
as the temporal correlation**

**between the depth maps and the
motion in texture, motion locus
perdition can be achieved for**

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**speeding up the texture coding in
an HEVC encoder. The depth
information brings new room for
designing an efficient adaptive**

search range (ASR) algorithm in

HEVC. Simulation results show

that the proposed ASR algorithms

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can offer a significant complexity reduction with negligible loss of coded video quality.

Analysis and Implementation of Fast Motion Estimation Algorithms for H.264 Video Coding

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Motion Estimation and Encoding

Algorithms for Hierarchical

Representation of Digital Video

Motion Estimation Techniques by

Exploiting Motion History and

Depth Maps in Video Coding

A Thesis

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Techniques and Algorithms for

H.264/AVC Video Compression

This book is about a thesis defended in 2007 that is interested in the development of algorithms for the estimation of movement between two

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successive images for video processing and coding applications. Block matching techniques are generally the most widely used. In this context, the best solution from the quality point of view is represented by an algorithm of exhaustive research. However, this

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Video Compression The algorithm requires a huge computational complexity. Different suboptimal solutions have been proposed in the literature, but an alternative approach to the problem in the frequency domain is still missing. This thesis proposes fast algorithms to

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accelerate the process of a comprehensive search using different metrics. The approaches introduced, unlike several proposed solutions, are not based on the spatial domain, rather they use the domain frequency. The proposed methods make it possible to

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provide computation time deterministic and fast while maintaining a high-quality motion estimation equivalent to an exhaustive search.

Video frame rate up-conversion is an important issue for multimedia systems in achieving better video quality and

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motion portrayal. Motion-compensated methods offer better quality

interpolated frames since the

interpolation is performed along the motion trajectory. In addition,

computational complexity, regularity, and memory bandwidth are important

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for a real-time implementation. Motion-compensated frame rate up-conversion (MC-FRC) is composed of two main parts: motion estimation (ME) and motion-compensated frame interpolation (MCFI). Since ME is an essential part of MC-FRC, a new fast

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motion estimation (FME) algorithm capable of producing sub-sample motion vectors at low computational-complexity has been developed. Unlike existing FME algorithms, the developed algorithm considers the low complexity sub-sample accuracy in

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designing the search pattern for FME. The developed FME algorithm is designed in such a way that the block distortion measure (BDM) is modeled as a parametric surface in the vicinity of the integer-sample motion vector; this modeling enables low

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computational-complexity sub-sample motion estimation without pixel interpolation. MC-FRC needs more accurate motion trajectories for better video quality; hence, a novel true-motion estimation (TME) algorithm targeting to track the projected object

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motion has been developed for video processing applications, such as motion-compensated frame interpolation (MCFI), deinterlacing, and denoising. Developed TME algorithm considers not only the computational complexity and

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regularity but also memory bandwidth. TME is obtained by imposing implicit and explicit smoothness constraints on block matching algorithm (BMA). In addition, it employs a novel adaptive clustering algorithm to keep the low-complexity at reasonable levels yet

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The Springer International Series In Engineering And Computer Science enable exploiting more spatiotemporal neighbors. To produce better quality interpolated frames, dense motion field at the interpolation instants are obtained for both forward and backward motion vectors (MVs); then, bidirectional motion compensation

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using forward and backward MVs is applied by mixing both elegantly.

Block Matching Algorithm for Video Coding

Fundamentals, Algorithms, and

Standards, Second Edition

Fast Motion Estimation Algorithms for

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Computationally Efficient Motion
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Computer-Aided Developments:
Electronics and Communication
Video technology promises to be

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the key for the transmission of motion video. A number of video compression techniques and standards have been introduced in the past few years, particularly the MPEG-1 and MPEG-2 for interactive multimedia and for digital NTSC and HDTV

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applications, and H.261/H.263 for video telecommunications. These techniques use motion estimation techniques to reduce the amount of data that is stored and transmitted for each frame. This book is about these motion estimation algorithms, their

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complexity, implementations,

advantages, and drawbacks. First,

we present an overview of video

compression techniques with an

emphasis to techniques that use

motion estimation, such as MPEG

and H.261H.263. Then, we give

a survey of current motion

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estimation search algorithms,
including the exhaustive search

and a number of fast search

algorithms. An evaluation of

current search algorithms, based

on a number of experiments on

several test video sequences, is

presented as well. The theoretical

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framework for a new fast search
algorithm, Densely-Centered

Uniform-P Search (DCUPS), is

developed and presented in the

book. The complexity of the

DCUPS algorithm is comparable

to other popular motion

estimation techniques, however

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the algorithm shows superior results in terms of compression ratios and video quality. We should stress out that these new results, presented in Chapters 4 and 5, have been developed by Joshua Greenberg, as part of his M.Sc. thesis entitled "Densely-

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Centered Uniform P-Search: A
Fast Motion Estimation Algorithm"
(FAU, 1996).

With the increasing popularity of
technologies such as Internet
streaming video and video
conferencing, video compression
has become an essential

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component of broadcast and entertainment media. Motion Estimation (ME) and compensation techniques, which can eliminate temporal redundancy between adjacent frames effectively, have been widely applied to popular video

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compression coding standards
such as MPEG-2, MPEG-4.

Traditional fast block matching
algorithms are easily trapped into
the local minima resulting in
degradation on video quality to
some extent after decoding. Since
Evolutionary Computing

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Techniques are suitable for achieving global optimal solution, these techniques are introduced to do Motion Estimation procedure in this thesis. Zero Motion prejudgement is also included which aims at finding static macroblocks (MB) which do

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not need to perform remaining search thus reduces the computational cost. Simulation results obtained show that the proposed Clonal Particle Swarm Optimization algorithm given a very good improvement in reducing the computations

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overhead and achieves very good Peak Signal to Noise Ratio (PSNR) values, which makes the techniques more efficient than the conventional searching algorithms. To reduce the Motion vector overhead in Bidirectional frame prediction, in this thesis

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novel Bidirectional Motion
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Estimation algorithm based on
Engineering And Computer
PSO is also proposed and results
Source shows that the proposed method
can significantly reduces the
computational complexity
involved in the Bidirectional
frame prediction and also least

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prediction error in all video
sequences.

Motion estimation algorithms for
video coding based on Kalman
filtering

New Efficient Block-based Motion
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Compression and Their Hardware

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Implementations
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Real-Time Video Compression
Motion Estimation Algorithms for
Video Compression
Image and Video Compression for
Multimedia Engineering
MPEG-4 is the multimedia

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standard for combining
interactivity, natural and
synthetic digital video, audio
and computer-graphics. Typical
applications are: internet, video
conferencing, mobile
videophones, multimedia

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cooperative work, teleteaching
and games. With MPEG-4 the
next step from block-based
video (ISO/IEC MPEG-1, MPEG-2,
CCITT H.261, ITU-T H.263) to
arbitrarily-shaped visual objects
is taken. This significant step

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demands a new methodology for system analysis and design to meet the considerably higher flexibility of MPEG-4. Motion estimation is a central part of MPEG-1/2/4 and H.261/H.263 video compression standards

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and has attracted much attention in research and industry, for the following reasons: it is computationally the most demanding algorithm of a video encoder (about 60-80% of the total

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computation time), it has a high
impact on the visual quality of a
video encoder, and it is not
standardized, thus being open
to competition. Algorithms,
Complexity Analysis, and VLSI
Architectures for MPEG-4

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Motion Estimation covers in detail every single step in the design of a MPEG-1/2/4 or H.261/H.263 compliant video encoder: Fast motion estimation algorithms Complexity analysis tools Detailed complexity

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quality analysis of fast motion
estimation algorithms within
MPEG-4 Design space on motion
estimation VLSI architectures

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Detailed VLSI design examples of (1) a high throughput and (2) a low-power MPEG-4 motion estimator. Algorithms, Complexity Analysis and VLSI Architectures for MPEG-4 Motion Estimation is an

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important introduction to
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numerous algorithmic,
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architectural and system design
Science
aspects of the multimedia
standard MPEG-4. As such, all
researchers, students and
practitioners working in image

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processing, video coding or
system and VLSI design will find
this book of interest.

The need of video compression
in the modern age of visual
communication cannot be over-
emphasized. This monograph

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will provide useful information to the postgraduate students and researchers who wish to work in the domain of VLSI design for video processing applications. In this book, one can find an in-depth discussion

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of several motion estimation algorithms and their VLSI implementation as conceived and developed by the authors. It records an account of research done involving fast three step search, successive elimination,

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one-bit transformation and its effective combination with diamond search and dynamic pixel truncation techniques.

Two appendices provide a number of instances of proof of concept through Matlab and

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Verilog program segments. In this aspect, the book can be considered as first of its kind. The architectures have been developed with an eye to their applicability in everyday low-power handheld appliances

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including video camcorders and smartphones.

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Fast Algorithms for Motion
Estimation in Video Sequences

Using Frequency Domain

Search Pattern Analysis and

Partial Distortion Measurement

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Search Algorithm for Video

Motion Estimation

Efficient Algorithms and

Architectures

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Efficient Motion Estimation and
Quantization Algorithms for
Low-bit-rate Video Coding

***Real-Time Video Compression:
Techniques and Algorithms
introduces the XYZ video
compression technique, which***

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*operates in three dimensions,
eliminating the overhead of motion
estimation. First, video
compression standards, MPEG and
H.261/H.263, are described. They
both use asymmetric compression
algorithms, based on motion
estimation. Their encoders are*

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much more complex than decoders.

The XYZ technique uses a

symmetric algorithm, based on the

Three-Dimensional Discrete Cosine

Transform (3D-DCT). 3D-DCT was

originally suggested for

compression about twenty years

ago; however, at that time the

computational complexity of the algorithm was too high, it required large buffer memory, and was not as effective as motion estimation. We have resurrected the 3D-DCT-based video compression algorithm by developing several enhancements to the original

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**algorithm. These enhancements
make the algorithm feasible for real-
time video compression in**

**applications such as video-on-
demand, interactive multimedia,
and videoconferencing. The**

**demonstrated results, presented in
this book, suggest that the XYZ**

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video compression technique is not only a fast algorithm, but also

provides superior compression

ratios and high quality of the video

compared to existing standard

techniques, such as MPEG and

H.261/H.263. The elegance of the

XYZ technique is in its simplicity,

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which leads to inexpensive VLSI implementation of any XYZ codec. Real-Time Video Compression: Techniques and Algorithms can be used as a text for graduate students and researchers working in the area of real-time video compression. In addition, the book serves as an

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*essential reference for
professionals in the field.*

*The objective of my research is
reducing the complexity of video
coding standards in real-time
scalable and multi-view
applications.*

Analysis of Motion Estimation

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