EXPERT TRAINING. ON SITE, ON TARGET !

FOUR INTENSIVE ON-SITE SHORT COURSES IN

Digital Television, MPEG and Video Compression

- **MPEG-2 & Alternative Video Compression Standards and Techniques**
  3-day course

- **Digital Television (DTV): Next Generation Technology and Applications**
  3-day course

- **MPEG-4/H.264 & MPEG-7 Multimedia Standards**
  2-day course

- **Digital Video Basics**
  - analog & digital TV basics and signal processing
  2-day course

Instructor: Dr. Jordan Isailovic

Video Compression
Digital Television
MPEG Short Courses

Video Design House
Training Department

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www.advancedinteractive.com/jordan

MPEG-2 and Alternative Video Compression Standards and Techniques

on-site 3-day course (1.8 CEUs)

Course Focus

How bad is good enough: JPEG, MPEG-1, MPEG-2, MPEG-4, MPEG-7, MPEG-21 . . .

The Moving Picture Experts Group (MPEG) was formed to establish an international standard for the coded representation of video and associated audio.

The bit rate is reduced by exploiting the psychovisual properties of the human visual system as well as statistical redundancies in the image data. The MPEG-1 algorithm utilizes motion estimation/ compensation for the reduction of temporal redundancy and discrete cosine transform (DCT) for the reduction of spatial redundancy. To achieve additional compression on video data, variable length code (VLC) is also used. Another characteristic of the MPEG-1 video compression algorithm is the introduction of a bi-directional prediction method.

The MPEG-2 standard is designed for high quality use in broadcast and telecommunications applications. MPEG-2 features CCIR 601 resolution video - similar to D-1 tape (704x480 pixels/frame, NTSC; 704x576 pixels/frame, PAL) at data rates of 3 to 15 Mbits per second, and the concept of scalability. It also provides support for the interlaced format, a 16:9 video aspect ratio, and multiple video and audio channels within the same stream. In addition, MPEG-2 provides an extension ability to HDTV.

Course Overview

This course provides a theoretical, intuitive and practical basis for the coding of images into digital form and their compression. Additionally, this course covers MPEG standards and alternative proprietary compression algorithms/standards. Compression testing, available tools and major artifacts associated with video compression are surveyed. A review of the opportunities and obstacles is given.

Who Should Attend

The course is designed for scientists, engineers and technical managers involved in design specification, implementation, management, or utilization of video compression systems and others who wish to acquire knowledge of the video compression technology field. This course provides participants with the mathematical and conceptual background required to understand, design, implement, and evaluate video compression systems, in particular the MPEG-2 standard. Patent lawyers should also find it useful.

Attendees will benefit from the in-depth coverage of MPEG-1-2 compression standards as well as summarized current status of MPEG-4 and MPEG-7 standards and their relationship with other multimedia technologies and standards. Upon completion of this course, students will be equipped with the background that will help them understand the performance limitations of various compression solutions.

Although video compression is mathematically based, it is not assumed that attendees are familiar with higher level math: modern algebra, fractals, wavelets, etc.

Course Objectives

- Provide background for understanding the MPEG standards
- Introduce the student to both compression standards (MPEG) and proprietary digital video formats
- Acquaint the student with their (standards/formats) capabilities and applications
- Compare the MPEG-2 algorithm with other approaches to video compression
- Consider opportunities and obstacles

Topic Outline

Day 1

Introduction
- Description of Course Structure and Content
- Course Objectives
- Standards Overview

Analog TV: Basic Concepts

Digital TV: Component vs. Composite
- Theoretical Base for Compression/Decompression
- Need for Data Compression
- Information Theory Concepts
- Visual Psychophysics
- Predictive Coding
- Motion Estimation
- Transform Coding
- Subband Coding
- Vector Quantization, etc.

Examples of Codec Designs
- p*64 Standard
- JPEG Standard

MPEG-1 Standard
- Functional Block Diagrams
- Syntax and Semantics
- Video Compression
- Audio Compression
- System Layer
- Example: MUX for CD

Day 2

MPEG-2 Standard
- Video Compression
- Audio Compression
- System Layer
- Program and Transport Streams
- Comparison with MPEG-1

MPEG-2 Distribution
- Optical Recording of the MPEG-2 Data Stream
- Satellite and Cable TV Distribution

continued from previous page

Day 3

Non-PEG Compression
- Wavelet Transform Coding and Compression
- Fractal Image Compression
- Autosophy Compression

Critical Design Issues
- DSP vs. Dedicated MPEG-1-2 IC's
- Hardware vs. Software Solutions
- Decoder Synchronization
- Format Conversion

Limitations of Source Coding

Major Artifacts Associated with Video Compression
- Subjective Evaluations

Applications
- What is Available – Current Products
- Present and Future
- Opportunities and Obstacles
- Intellectual Properties
- Markets
- Testing Tools

Instructor

Dr. Jordan Isailovic, scientist, JRI Technology and California State University , is author of *Videodisc and Optical Memory Technologies* and *Videodisc Systems: Theory and Applications*. He has authored numerous technical articles and holds several patents on digital information storage techniques and video signal processing. He presented the world's first public engineering course on videodisc technology (January 1982) and taught the world's first graduate courses on videodisc and optical memories (CD, CD-ROM, etc.).

His research projects include the following areas: three-dimensional optical memories, channel coding for optical recording, machine vision, image processing,testing methodology for the visualy-lossless compression, etc. For the lectures, he wrote four manuscripts: Optical Compact Systems (including CDs and CD-ROMs) , Advanced Digital Systems Design, Guide to Frame Grabber Design, and Multimedia PC Architecture and Design.

Dr. Isailovic's current research primarily focuses on video compression - a subject closely related to his Ph.D. thesis in which, among other things, he established the theoretical limits for TV signal compression based on 3D predictive coding. As a consultant, he has evaluated a great number of MPEG-2 encoders and decoders.
For Advanced Interactive Inc. he designed the Non-Peg Interactive TV set-top Box. He represented Packard Bell-NEC in the DVD Copy Protection Technical Working Group (CPTWG), represented Lucas Film and Technicolor in MPEG, and is still active on the MPEG committee and CPTWG. He co-chaired MPEG Digital Cinema AHG and still co-chairs SMPTE working group on DVD Authoring.

Currently, Dr. Isailovic is consulting in the field of digital cinema: evaluating/testing compression techniques, proposing system designs, participating in Standard comities on digital cinema, etc.

Fee

The On-Site training course fee will guarantee space for up to 12 of attendees. (Please send us an email a to : jordan@advancedinteractive.com or call (714)921-2286 to request an immediate quote for our training courses.)

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- Extensive set of notes, which cover all the visuals used in the course
- Pre-course preparatory homeworks
- Course Diploma issued by instructor

Powerful modularized course design meets your needs...

5 Day Full Course
(money savings, and covering all MPEG, DTV basics in one course!)

4 Day MPEG-2 DTV Course

EFFECTIVE TRAINING. ON SITE, ON TARGET !

On-Site Course Benefits:

- **Tailored to your specific needs**
- **Enjoy confidentiality** - freely discuss your company's needs
- **May be scheduled at your convenience**
- **Significant per attendee savings -** eliminate travel and time away from the office
- **Quality course documentation**

Digital Television (DTV): Next Generation Technology and Applications

on-site 3-day course (1.8 CEUs)

Course Summary

There has been a quantum shift, imperceptible to the viewer, in the technology used to bring television into the home: the winning choice is digital technology. Digital TV (DTV) is the umbrella term used to describe the new digital television system adopted by the FCC in December 1996; DTV is a technology, and HDTV is just one subset of the DTV.
The objective of the course is to bring the participants gracefully through all the DTV structure, features, and theory…then give them more practical information on subjects such as decoding issues, display problems, conversion, baseband data stream handling, etc. The course will also provide an in depth and structured introduction to the technology, its uses, opportunities/ possibilities, and limitations. Digital TV is not simply the numerical equivalent to traditional analog television: the issues of becoming digital are covered, as well as the relevant compression technologies.

Participants will enhance their knowledge of the principles of transmission, as well as problems and opportunities of data delivery through terrestrial, satellite and cable networks. Insight is also provided on the receiver issues and how they will handle format conversion as well as conditional access. Participants will gain a point-by-point understanding of the DTV layered architecture, DTV transmission requirements, multiplexing, MPEG switching, audio components, compatibility with today's analog TV, and more.

Course Objectives

- Provide background for understanding the DTV standards
- Discuss enabling technologies
- Review the fundamentals of underlying modulation techniques
- Discuss specifics of ATSC, DVB-B-C Systems
- Discuss critical design issues
- Discuss technical aspects related to copy protection
- Discuss basic problems in the system integration
- Discuss opportunities and obstacles

Who Should Attend

The course is intended for video engineers who will have to use the technology. The mathematics of compression techniques are discussed briefly, but the focus of the course is on providing a qualitative understanding of the processes involved rather than their detailed analysis. If you are looking for real world answers and direction toward solutions, this course is for you.

Topic Outline

Day 1

Introduction
- Description of Course Structure and Content
- Course Objectives
- Standards Overview

Standard TV - Analog: Basic Concepts
Standard TV - Digital: Component vs. Composite

Day 1 (cont.)

Introduction to DTV/ATSC
Theoretical Base for Compression/Decompression
- Need for Data Compression
- Information Theory Concepts
- Visual Psychophysics
- Predictive Coding
  - Motion Estimation
  - Motion Compensation
- Transform Coding
- Subband Coding
- Vector Quantization, etc.

DCT xPEG (JPEG)
- Baseline Processing
- Variable Length Coding

Day 2

MPEG-1 Standard
- Functional Block Diagrams
- Syntax and Semantics
- Video Compression
- Audio Compression
- System Layer

MPEG-2 Standard
- Video Compression
- Audio Compression
  - MPEG-1-2 Audio and AAC vs. AC-3
- System Layer
- Program and Transport Streams
- Comparison with MPEG-1

MPEG-2 Distribution
- Optical Recording of the MPEG-2 Data Stream
- DTV-Broadcast/ATSC

Day 3

Satellite and Cable TV Distribution (DSS, DVB - Broadcast/Cable, ATSC)
Critical Design Issues
- DSP vs. Dedicated MPEG-1-2 IC's
- Hardware vs. Software Solutions
- Clock Recovery and Synchronization Issues
- Sampling Strategies and Structures
- CCIR-601 4:2:2 and 4:2:0; Interlaced/Noninterlaced
- VLSI Implementation
- MPEG Processing Architecture and Implementation
- Architectural choices
- Format Conversion

Limitations of Source Coding
Major Artifacts Associated with Video Compression
- Subjective Evaluations of Digitally Compressed Video

MPEG-4-7
Applications
- What is Available – Current Products
- Present and Future
  - Future A/V Standards

continued from previous page

Day 3 (Cont.)

Opportunities and Obstacles
Patent Obligations
Markets
Testing Tools

Instructor

Dr. Jordan Isailovic , scientist, JRI Technology and California State University. (see page 3)

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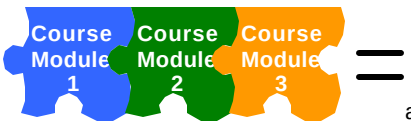
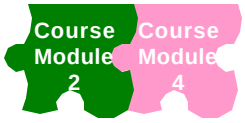


= **5 Day Full Course** (money savings, and covering all MPEG, DTV basics in one course!)

= **4 Day Intensive DTV, MPEG-4, -7 Course**



= **4 Day Intensive Digital Video and DTV Course**

About our clients:

Dr. Jordan Isailovic has been providing on-site and public courses to many clients including leading technology companies and key decision makers like: ADC, Ampex, ATI, AT&T, Boeing, Broadcom, Cadence, C-Cube, Cisco, Cal State Northridge, DirecTV, Diva, Extron, Echostar, GI, Hitachi, HP, Hyundai, IBM, Intel, Kodak, LSI Logic, Lucas Film, THX, Macrovision, Microsoft, Mitsubishi, Motorola, NASA, NEC, ODC, OptiBASE, OptiVision, Packard Bell, Pioneer, Polaroid, Qualcomm, Quantum, Rockwell, Sharp, S3, Samsung, Sony, TDC, Technicolor, Tektronix, Thomson, TI, Toshiba, VLSI, Zapex, Zenith, Zilog and many more...

ATSC
Advanced Television Systems Committee. In 1978, the Federal Communications Commission (FCC) empanelled the Advisory Committee on Advanced Television Service (ACATS) as an investigatory and advisory committee to broadcast television (ATV) standard for the United States. This committee created a subcommittee, the ATSC, to explore the need for and to coordinate development of the documentation of Advanced Television Systems. In '93 the ATSC recommended that efforts be limited to a digital television system (DTV), and in '95 issued its recommendation for a Digital Television System standard, which was approved with the exclusion of compression format constants (picture resolution, frame rate, and frame sequence).

HDTV
High Definition Television. This term refers to high-resolution TV standards. HDTV is defined as having twice the vertical and twice the horizontal resolution of conventional television, a picture aspect ratio of 16:9, a frame rate of at least 24 Hz and at least two channels of CD quality sound. HDTV is capable of generating pictures substantially brighter, sharper and of better colorimetry than 35 mm motion picture film. HDTV equipment is now commercially available and HDTV is expected to be of great importance in industrial, scientific and medical applications, as well as in entertainment.

SDTV
Standard Definition Television. A term applied to traditional 4:3 TV in analog or digital form with a resolution of about 700 x 480 pixels. See HDTV.

QAM
Quadrature amplitude modulation. This modulation format encodes the source data into independent in-phase and quadrature carrier components. QAM modulation is two-dimensional in the sense that the resulting signal can be represented in the complex plane.

VSB
Vestigial sideband modulation (also called VSB-AM (amplitude modulation)). This modulation format encodes data into the amplitude of a single carrier frequency. Portions of one of the redundant AM sidebands are removed to form a vestigial sideband signal. VSB signals can be treated either as a one-dimensional AM signal or as a two-dimensional complex signal similar to the representation used for QAM.

DTV Headlines

FCC orders mandatory DTV tuners

By a vote of 3 to 1, the FCC has ordered electronics manufacturers to integrate digital tuners into nearly all-new consumer television receivers.

Beginning July 1, 2004, with a one-year phase-in, TV sets with screen sizes of 36 inches and larger must include digital tuners. All sets 13 inches and larger must include the tuners by July 1, 2007.

To schedule an on-site course, contact us today.

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MPEG-4/H.264 & MPEG-7 Multimedia Standards

on-site 2-day course (1.2 CEUs)

Course Description

MPEG-4 and MPEG-7 are ISO/IEC standards developed by MPEG (Moving Picture Expert Group). MPEG-4 provides the standardized technological elements enabling the integration of the production, distribution and content access paradigms of the three fields: digital television, interactive graphic applications (synthetic content), and interactive multimedia (WWW; distribution of and access to content). An in-depth coverage of MPEG-4 is presented in this Course, including AVC/Part-10/H.264. First, the theoretical base – tools, concepts, principals – required for the understanding MPEG-4, is covered. Next, Video coding is discussed in details. After that the rest of the MPEG-4 Standard is reviewed. Applications, opportunities and obstacles are covered. An introduction to a multimedia content description standard, MPEG-7, is presented.

Course Objectives

At the completion of this course, students will have a basic understanding of how MPEG-4, and -7 work. They will be familiar with the various compression algorithms and technologies. Students will learn to identify common problems with digital video quality, their causes, and solutions. In addition, students will learn MPEG-4, and MPEG-7 basics and terminology.

Who Should Attend

The course is intended for video, R&D engineers who need to use the technology for developing the next generation audio-visual products, and for systems devlopers, decision makers and others who seek a detailed understanding of new technoghies in the MPEG area.

Topic Outline

Day 1

MPEG-4 Standard Overview Version 1, Version 2
Theoretical Base: tools, concepts, principles
- Summary - MPEAG-1-2 bases
- Arithmetic coding
- Shape representation: binary and gray-scale (alpha) planes
- Mash (object plane) based presentation
- Shape-adaptive DCT and DWT
- Global and local motion compensation
- RVLC, etc.

MPEG-4 Video
- Natural video coding
- Texture coding
- Synthetic video

Advanced Video Coding (AVC) - H.264

Day 2

MPEG-4 Systems
- System Decoder Model
- Scene Description
- Multiplexing; TransMux, FlexMux
- IPMP

MPEG-4 Audio
- SNHC audio

Delivery Multimedia Integration Framework (DMIF)
Future extensions
Applications
Introduction to MPEG-7

Instructor

Dr. Jordan Isailovic , scientist, JRI Technology and California State University. (see page 3)

Fee

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= **4 Day Complete MPEG Course**

= **4 Day Intensive DTV, MPEG-4, -7 Course**

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Digital Video Basics - analog & digital TV basics and signal processing

on-site 2-day course (1.2 CEUs)

Course Description

Digital television is about re-invention of the television industry via digital technology, just like digital computer re-invented the computing and documenting industries. This course is about Analog and Digital TV basics and relevant signal processing. The course covers the fundamental technology that lies at the heart of compression - particularly MPEG - and high definition television (HDTV), and Digital TV in general. It is recommended as an introductory course for the MPEG-2 or DTV course.

Course Objectives

At the completion of this course, students will have a basic understanding of how analog video is digitalized, carried, and tested. Students will gain an understanding of the processes involved in video encoding and decoding. They will be familiar with the color space and colorimetry, gamma processing, etc. Students will learn to identify common problems with digital video quality, their causes, and solutions. In addition, students will learn basic analog and digital video standards, principles standards are based on and terminology.

Who Should Attend

The course is intended for engineers who need to understand details of digital video and review analog video in order to master video signals for developing and designing products.

Topic Outline

Day 1

ANALOG TV: BASIC CONCEPTS
BLACK-and-WHITE TV SIGNAL
- Raster scan concept
- Interlacing (vs. progressive scanning)
  - Frame and
  - Field
- Time Domain:
  - SYNC: vertical and horizontal; composite
  - (ACTIVE) video signal
- Spectrum
- STANDARDS: RS 170, CCIR

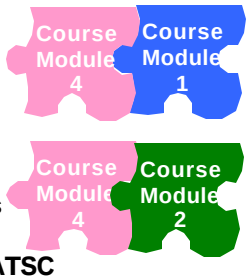
Day 1 (cont.)

INTRO to COLORIMETRY
COLOR TV SIGNAL
- Component: R G B; L-U-V; L-I-Q; L-Cr-Cb
  - LUMA/LUMINANCE
- Composite
- Gamma - Correction
- Inerleaving
  - CHROMA/CHROMINANCE
  - COLOR SUBCARRIER (fsc)
- Standards: NTSC (RS 170A), PAL, SECAM
- Color Bar

Day 2

DIGITAL TV
- Digitizing Video
- Component Digital
- Composite Digital
- Aspect Ratios
- Features & Benefits
- Signal processing

Introduction to ATSC



= **4 Day Digital Video and MPEG Course**

= **4 Day Digital Video & DTV Course**

Instructor

Dr. Jordan Isailovic , scientist, JRI Technology and California State University. (see page 3)

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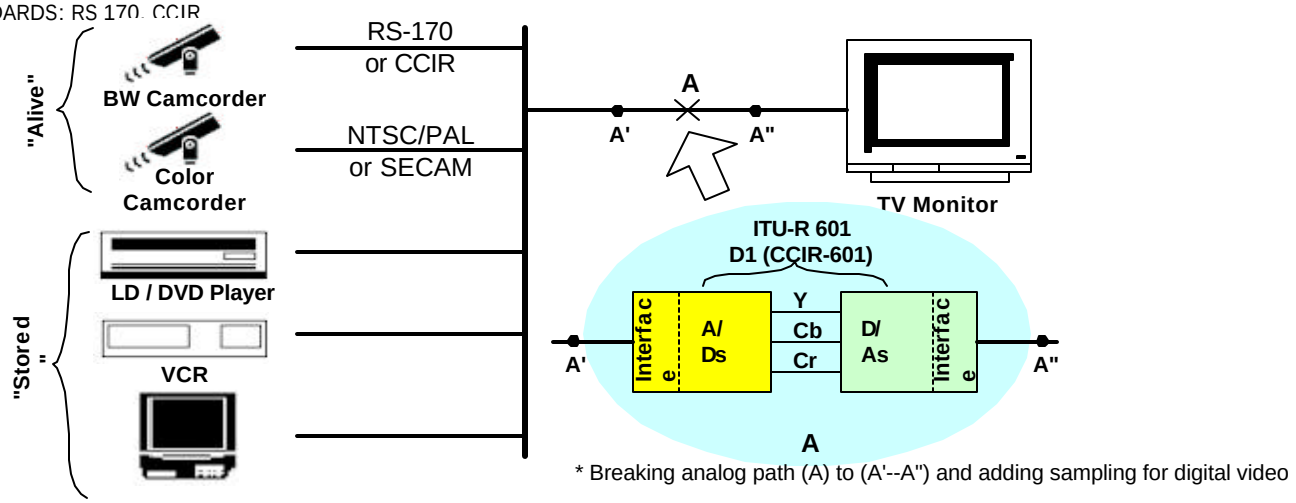

* Breaking analog path (A) to (A'--A") and adding sampling for digital video

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Check On-Site Courses inside or Public Courses offered on the web...

- MPEG-2 & Alternative Video Compression Standards and Techniques **See page 2**
- Digital Television (DTV): Next Generation Technology and Applications **See page 4**
- MPEG-4/H.264 & MPEG-7 Multimedia Standards **See page 6**
- Digital Video Basics **See page 7**
  - analog & digital TV basics and signal processing

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Training Department

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