

# Image & Video Quality

Learn to assess and improve image and video quality, from pixels and colour formats to objective metrics and compression.

**13**

MODULES

**51**

TOPICS

## COURSE OVERVIEW

This course covers the fundamentals of digital images and video, including pixels, resolution, colour representation, frame rate and scanning methods, followed by colour formats and colour space conversions used in compression and rendering. It then examines image and video quality parameters such as MTF, SNR, MSE, dynamic range, distortions, lighting effects and NIR signals with their visualization modes and separation challenges. Subjective and objective quality metrics, including MOS, PSNR, SSIM and VMAF, are addressed alongside tools for quality assessment. The course concludes with compression techniques, HDR imaging, computational photography and AI-based quality assessment models.

## WHO THIS COURSE IS FOR

Image Processing Engineers

Video Engineers

Quality Assessment Analysts

Computer Vision Developers

Broadcast Engineers

Imaging Researchers

## LEARNING OBJECTIVES

- Explain pixel, resolution, colour and frame rate fundamentals
- Compare RGB and YUV/YCbCr colour formats and chroma subsampling
- Apply matrix transformations between RGB, Lab, HSV and YCbCr
- Analyse image quality parameters such as MTF, SNR and dynamic range
- Assess lighting impact on image quality, including colour temperature
- Describe NIR capture principles and visualization modes
- Evaluate subjective and objective quality metrics such as MOS and VMAF
- Identify compression and advanced techniques such as HDR and AI-based IQA

# 13 Modules, 51 Topics

01

## Digital Image & Video Fundamentals

### PIXELS AND SAMPLING

- Definition of a pixel, Spatial resolution (DPI, PPI), Temporal resolution (frame rate)

### IMAGE RESOLUTION

- SD, HD, Full HD, 4K, 8K
- Impact on quality and storage

### COLOR REPRESENTATION

- RGB color model (24-bit, 8-bit channels)
- Grayscale and binary images

### FRAME RATE (FPS)

- Common standards: 24, 30, 60 fps
- Impact on motion perception

### INTERLACING VS. PROGRESSIVE SCAN

- Concepts, use in broadcast

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## Color Formats

### TOPICS

- RGB vs. YUV/YCbCr: visual perception and compression efficiency
- Chroma Subsampling: 4:4:4, 4:2:2, 4:2:0
- Use cases in broadcasting and compression

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## Color Space Conversions

### TOPICS

RGB, Lab, HSV and YCbCr · Matrix transformation formulas · Applications in compression, HDR, rendering

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## Image Quality Parameters

### TOPICS

- **MTF:** Spatial frequency response
- **SNR:** Noise quantification
- **MSE:** Mean Squared Error
- **Dynamic Range:** Log scale, HDR
- **Distortions and Artifacts:** Blur, aliasing, noise, moire

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## Video Quality

### TOPICS

Frame rate and motion perception · Motion blur and capture methods · Synchronization of audio and video

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## Lighting Impact on Image Quality

### TOPICS

- Natural vs. artificial light sources
- Color temperature (Kelvin scale)
- **Low-light challenges:** noise, blur, color shift

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## Basics of NIR Signals

### TOPICS

- Principles of NIR capture, sensor characteristics, and applications

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## Visualization Modes (NIR Integration)

### TOPICS

- **White Light Mode:** RGB image
- **Green Overlay Mode:** RGB + NIR signal added in green channel
- **Color Mode:** RGB + NIR signal added in green channel (different rendering)
- **Contrast Mode:** Pure NIR grayscale image

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## Subjective Quality Metrics

### TOPICS

- MOS (Mean Opinion Score) and DMOS (Difference in Mean Opinion Score): ITU protocols
- ACR, DSCQS, SAMVIQ methods
- Crowdsourcing quality assessments

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## Objective Quality Metrics

### TOPICS

- PSNR: Formula, interpretation
- SSIM, MS-SSIM: Structure-based metrics
- VMAF: Fusion metric from Netflix
- NSS: Natural Scene Statistics
- BRISQUE, NIQE: No-reference image quality metrics

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## Tools for Quality Assessment

### TOPICS

- Open Source IQA Tools: Python + OpenCV + SKImage
- Open-Source Alternatives to Imatest: ImageJ + Plugins (Fiji distribution)
- Python: Quality metric implementation

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## NIR Signal Separation Challenges

### TOPICS

- Feasibility of separating NIR from each visualization mode
- Modes where separation is possible and limitations

### METHODOLOGIES

- Spectral channel analysis
- Blind source separation (PCA, ICA)
- Image differencing & filtering techniques

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## Compression & Advanced Topics

### TOPICS

- JPEG: DCT, quantization, progressive modes
- Video Compression: H.264/H.265, motion estimation, GOP
- HDR Imaging: Exposure fusion, tone mapping
- Computational Photography: Super-resolution, Low light enhancement, Denoising
- AI-based Quality Assessment: CNN and Transformer-based IQA models, LIVE/TID datasets

#### WHAT IS INCLUDED

## Everything You Need to Succeed

- Koenig course material for every module
- Delivery by certified instructors and subject matter experts
- Hands-on exercises throughout the course
- Course completion certificate from Koenig

#### ABOUT KOENIG

## Who We Are

Established in 1993, Koenig Solutions is a globally recognised training provider with 35+ technology partnerships, 5,000+ training programmes and a network of certified instructors and subject matter experts, supporting individuals and enterprise teams worldwide.

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