



# AI in Computer Vision for Images, Video, and Real-World Applications (Level 3)

## Learning Mode:

Online via Zoom

## Duration:

5 Days

## This course is specifically designed to provide participants with:

- The ability to understand how image and video data can be transformed into meaningful insights for better decision-making.
- Practical skills to preprocess and analyze images and video using standard Python tools and libraries.
- Hands-on experience in designing and training simple CNN-based models for image classification and basic detection tasks.
- Knowledge to evaluate and improve the robustness of computer vision systems under real-world conditions, including variations in lighting, noise, and motion.
- The capability to plan, prototype, and apply computer vision solutions to address organizational challenges such as quality inspection, safety monitoring, and process optimization.

## Projects and challenges:

The course will include practical mini-projects and case studies such as:

- Image-based defect detection: classify or localize defective vs non-defective parts from production lines.
- Object detection on images: detect specific tools, products, or vehicles in scenes.
- Video-based counting and tracking: count people or vehicles passing through a region and track movement.
- Safety or compliance monitoring: detect presence/absence of safety equipment (e.g. helmet, vest) in images or short clips.

## Course Overview

### SUMMARY

Computer Vision for Images and Video: Methods, Applications, and Real-World Challenges equips participants with practical skills to turn image and video data into actionable insights using AI. The course covers foundational image processing, classical computer vision techniques, and deep learning methods such as CNNs for image classification, object detection, and basic segmentation. Participants will also learn video analysis, motion tracking, and strategies to handle real-world challenges like lighting, occlusion, and data limitations.

Through hands-on projects and case studies, participants gain experience designing, training, and evaluating vision models for applications such as defect detection, safety monitoring, counting, and tracking. By the end of the course, participants are prepared to prototype and implement computer vision solutions across manufacturing, healthcare, smart transportation, security, and other sectors.

## Course Content

### MODULE 1

#### Foundations

- Fundamentals of digital images: pixels, resolution, color spaces
- Image enhancement and filtering (denoising, contrast, basic transformations)

### MODULE 2

#### Classical computer vision

- Edge detection, feature detection, and descriptors (conceptual level).
- Basic geometric concepts: perspective, camera view, simple alignment.

### MODULE 3

#### Deep learning for images

- Introduction to convolutional neural networks (CNNs).
- Transfer learning and fine-tuning pre-trained models.
- Image classification, object detection, and basic segmentation (concepts + examples).

### MODULE 4

#### Video Understanding

- Representation of video as sequences of frames.
- Motion and basic tracking concepts (tracking-by-detection, simple trackers).
- Crowd, vehicle, and activity monitoring scenarios.

### MODULE 5

#### Real-world application and deployment challenges

- Dealing with changing lighting, shadows, reflections, blur, occlusion.
- Data preparation: labeling, annotation tools, class imbalance, small datasets.
- Evaluation under real conditions: speed, latency, false alarms, robustness.
- Basic deployment pathways: running models on servers and edge devices (high level).