Training Course on Video Analysis and Action Recognition

Professional Development Training Course Outline

Category	Data Science	**Duration**	10 Days
Base Fee	$3,000 USD	**Delivery Mode**	Online / On-site Hybrid

Course Introduction

In today's data-rich environment, the ability to extract meaningful information from sequential image data is a game-changer across industries. Training Course on Video Analysis & Action Recognition provides a comprehensive deep dive into cutting-edge techniques and **Deep Learning** methodologies. Participants will gain practical skills in processing, interpreting, and generating actionable insights from vast amounts of **video data**, driving efficiency and innovation in their respective fields.

This program bridges the gap between raw visual information and strategic decision-making. By mastering **Computer Vision** and **Machine Learning** algorithms, attendees will learn to automatically detect, track, and classify activities within video streams. This expertise is crucial for optimizing operations, enhancing security, and developing intelligent automation solutions in a rapidly evolving technological landscape.

Programme Curriculum

Training Course on Video Analysis & Action Recognition

Introduction

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Course Objectives

1. Grasp the core principles of **video processing**, **computer vision**, and **action recognition**.
2. Learn effective techniques for **video data preprocessing**, **feature extraction**, and normalization.
3. Implement and evaluate state-of-the-art **object detection** algorithms (e.g., YOLO, Faster R-CNN) for video content.
4. Develop skills in **multi-object tracking** and understanding popular tracking algorithms (e.g., Kalman Filters, SORT).
5. Explore methods for **human pose estimation** and its application in action recognition.
6. Master various **action classification** and **activity recognition** algorithms, including **Deep Learning** models.
7. Understand **spatiotemporal features** and their importance in recognizing dynamic actions.
8. Design and implement solutions for **real-time video analytics** and streaming data processing.
9. Apply **anomaly detection** techniques to identify unusual behaviors and events in video streams.
10. Analyze the ethical implications of **AI in video analysis**, including **privacy concerns** and algorithmic bias.
11. Gain practical experience in **deploying machine learning models** for video analysis and optimizing their performance.
12. Apply learned concepts to diverse real-world **case studies** across industries like **smart surveillance** and **sports analytics**.
13. Develop the ability to customize and train **deep learning models** for specific video analysis tasks.

Organizational Benefits

- Proactive threat detection, improved incident response, and automated monitoring systems.
- Streamlined workflows, reduced manual inspection, and optimized resource allocation through **intelligent video analytics**.
- Unlocking actionable insights from visual data for strategic planning and performance optimization.
- Automated defect detection and adherence to safety protocols in manufacturing and industrial settings.
- Understanding customer behavior, footfall patterns, and engagement in retail environments.
- Leveraging cutting-edge **AI technologies** to gain a distinct edge in their respective markets.
- Minimizing losses due to theft, inefficiencies, and manual labor through automated video intelligence.

Target Audience

1. Data Scientists and Machine Learning Engineers
2. Computer Vision Researchers and Developers
3. Security Analysts and Surveillance Professionals
4. Automation Engineers and Process Optimization Specialists

5. AI/ML Enthusiasts with programming experience
6. Academicians and Researchers in related fields
7. Product Managers overseeing AI-driven solutions
8. Solution Architects designing intelligent video systems

Course Outline

Module 1: Introduction to Video Analysis & Action Recognition

- Overview of Computer Vision and its applications.
- Fundamentals of digital video and sequential image data.
- Challenges and opportunities in video analysis.
- Introduction to the action recognition pipeline.
- Key historical milestones in video understanding.
- **Case Study:** Early applications of motion detection in security systems.

Module 2: Digital Image and Video Processing Fundamentals

- Image representation, color spaces, and filtering techniques.
- Video file formats, codecs, and compression.
- Temporal and spatial resampling for video data.
- Image and video enhancement techniques.
- Introduction to common libraries: OpenCV, FFmpeg.
- **Case Study:** Optimizing video quality for forensic analysis in public safety.

Module 3: Feature Extraction for Video Data

- Traditional feature descriptors (e.g., SIFT, HOG, optical flow).
- Deep learning features: Convolutional Neural Networks (CNNs) for spatial features.
- Recurrent Neural Networks (RNNs) and LSTMs for temporal dependencies.
- 3D CNNs for spatiotemporal feature learning.
- Designing effective feature extraction pipelines.
- **Case Study:** Using optical flow to analyze pedestrian movement patterns in retail.

Module 4: Object Detection in Video Streams

- Introduction to object detection algorithms (R-CNN, YOLO, SSD).
- Training and fine-tuning pre-trained object detection models.
- Real-time object detection considerations.
- Bounding box regression and non-maximum suppression.
- Performance metrics for object detection (mAP, IoU).
- **Case Study:** Detecting unauthorized objects or activity in restricted airport zones.

Module 5: Multi-Object Tracking

- Association algorithms for tracking multiple objects (e.g., SORT, DeepSORT).
- Kalman filters and their application in object tracking.
- Handling occlusions and re-identification challenges.
- Tracking by detection vs. detection by tracking.
- Evaluating tracking performance.
- **Case Study:** Tracking multiple athletes on a sports field for performance analysis.

Module 6: Human Pose Estimation

- Keypoint detection using deep learning models (e.g., OpenPose, AlphaPose).

- 2D vs. 3D pose estimation.
- Applications of pose estimation in human activity recognition.
- Data annotation for pose estimation.
- Challenges in real-world pose estimation.
- **Case Study:** Analyzing ergonomic posture in manufacturing to prevent injuries.

Module 7: Action Recognition with Traditional Methods

- Hand-crafted features for action recognition (e.g., MoFREAK, HOF).
- Bag-of-visual-words models for action representation.
- Support Vector Machines (SVMs) for classification.
- Hidden Markov Models (HMMs) for sequential data.
- Limitations of traditional approaches for complex actions.
- **Case Study:** Recognizing simple gestures for human-computer interaction in older smart home systems.

Module 8: Deep Learning for Action Recognition (Part 1: 2D & 3D CNNs)

- Introduction to 2D CNN architectures for video frames.
- Extending CNNs to 3D for spatiotemporal learning.
- Architectures like C3D, I3D, and R(2+1)D.
- Transfer learning and fine-tuning for action recognition.
- Datasets for action recognition (e.g., Kinetics, UCF101, HMDB51).
- **Case Study:** Classifying sports actions (e.g., "scoring a goal," "serving") in game footage.

Module 9: Deep Learning for Action Recognition (Part 2: RNNs & Transformers)

- Recurrent Neural Networks (RNNs) and LSTMs for modeling temporal sequences.
- Integrating CNN features with RNNs for action recognition.
- Attention mechanisms in sequential models.
- Transformer architectures for video understanding (e.g., VideoGPT, TimeSformer).
- Comparing different deep learning approaches for action recognition.
- **Case Study:** Recognizing complex, long-duration activities like "cooking a meal" from surveillance video.

Module 10: Anomaly Detection in Video

- Statistical methods for anomaly detection.
- One-class SVMs and Isolation Forests for outlier detection.
- Deep learning-based anomaly detection (e.g., autoencoders, GANs).
- Identifying unusual events or suspicious behaviors.
- Thresholding and alert generation.
- **Case Study:** Detecting abnormal movement patterns or unattended bags in public spaces.

Module 11: Real-time Video Analytics & Deployment

- Optimizing models for inference speed and efficiency.
- Deployment strategies for edge devices and cloud platforms.
- Streaming video processing frameworks.
- Scalability considerations for large-scale video analytics.
- Monitoring and maintaining deployed models.
- **Case Study:** Implementing a real-time system for monitoring traffic violations.

Module 12: Ethical Considerations & Privacy in Video Analysis

- Data privacy laws and regulations (e.g., GDPR).
- Bias in AI models and its impact on fairness.
- Responsible AI development and deployment.
- Anonymization and de-identification techniques for video data.
- Public perception and ethical guidelines for surveillance.
- **Case Study:** Discussing the ethical dilemmas of facial recognition in law enforcement.

Module 13: Project-Based Learning & Capstone

- Defining a real-world video analysis problem.
- Dataset selection and preparation.
- Model selection, training, and evaluation.
- Iterative model improvement and hyperparameter tuning.
- Presenting project outcomes and insights.
- **Case Study:** Participants work on a chosen project, e.g., developing a system to count customers entering a store or detecting falls in elderly care.

Module 14: Advanced Topics & Future Trends

- Self-supervised learning for video.
- Generative models for video synthesis and augmentation.
- Action anticipation and prediction.
- Multimodal fusion: combining video with audio, text, or sensor data.
- Research frontiers and emerging applications.
- **Case Study:** Exploring the potential of video analysis in autonomous vehicles for predicting pedestrian actions.

Module 15: Industry Applications & Business Impact

- Video analytics in smart cities, retail, and manufacturing.
- Applications in healthcare (e.g., patient monitoring, surgical analysis).
- Role of video analysis in sports performance enhancement.
- Leveraging video insights for business intelligence.
- Developing a strategic roadmap for video analytics adoption.
- **Case Study:** Analyzing worker productivity and safety adherence in a manufacturing plant using video data.

Training Methodology

This course employs a **blended learning approach** combining theoretical knowledge with extensive hands-on practice.

- **Interactive Lectures:** Engaging presentations explaining complex concepts with clear visuals and examples.
- **Practical Demonstrations:** Live coding sessions showcasing the implementation of algorithms and techniques.
- **Hands-on Labs:** Guided exercises and coding challenges using popular **Python libraries** (OpenCV, TensorFlow, PyTorch).
- **Real-world Case Studies:** In-depth analysis and discussion of industry-specific applications.
- **Individual and Group Projects:** Opportunities to apply learned skills to solve practical problems.
- **Expert-led Q&A Sessions:** Dedicated time for addressing participant queries and fostering deeper understanding.

- **Collaborative Learning Environment:** Encouraging peer-to-peer learning and knowledge sharing.

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Certification

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
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23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$6,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$9,000
23 Nov 2026	04 Dec 2026	Physical	$12,000
23 Nov 2026	04 Dec 2026	Physical	$12,000

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