Training Course on Image Classification with Transfer Learning

Professional Development Training Course Outline

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

Course Introduction

Training Course on Image Classification with Transfer Learning provides a comprehensive deep dive into **Image Classification** using the powerful technique of **Transfer Learning**. Participants will gain hands-on expertise in **leveraging pre-trained models** to efficiently solve complex **computer vision challenges** without the need for vast datasets or extensive computational resources. We will explore the latest advancements in **deep learning architectures** and their practical applications, enabling participants to build and deploy robust image classification solutions for a wide range of custom tasks.

The curriculum emphasizes **practical implementation** and **real-world problem-solving**, equipping learners with the essential skills to **fine-tune neural networks**, optimize model performance, and confidently tackle **data scarcity** issues. Through interactive sessions and **case studies**, attendees will master techniques for **feature extraction**, model adaptation, and achieving **state-of-the-art results** in diverse domains, from **medical imaging** to **industrial automation**. This course is crucial for anyone looking to accelerate their **AI development** and unlock the full potential of **visual data analysis**.

Programme Curriculum

Training Course on Image Classification with Transfer Learning

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Course Objectives

1. Grasp core concepts of **Neural Networks**, **Convolutional Neural Networks (CNNs)**, and their role in **Image Recognition**.
2. Comprehend the theory and benefits of **Transfer Learning** for **Computer Vision** tasks, including **inductive transfer** and **domain adaptation**.
3. Identify and differentiate popular **pre-trained models** like **ResNet**, **VGGNet**, **Inception**, **MobileNet**, and **EfficientNet** for diverse applications.
4. Learn to effectively use pre-trained CNNs as **fixed feature extractors** for new datasets.
5. Develop skills in **fine-tuning** pre-trained models by selectively unfreezing and retraining layers for optimal performance on custom data.
6. Apply transfer learning to mitigate **data scarcity** challenges in **image classification projects**.
7. Implement techniques for **hyperparameter tuning**, **learning rate scheduling**, and **early stopping** to enhance model accuracy and generalization.
8. Utilize various **evaluation metrics** (accuracy, precision, recall, F1-score) to assess and compare model performance.
9. Master **data preprocessing** and **data augmentation** strategies to prepare diverse image datasets for training.
10. Gain proficiency in implementing transfer learning using popular frameworks like **TensorFlow** and **PyTorch**.
11. Understand the deployment considerations for real-world **AI applications** involving image classification.
12. Diagnose and resolve common problems such as **overfitting**, **underfitting**, and vanishing gradients in deep learning models.
13. Explore emerging trends in **computer vision**, **generative AI**, and their intersection with transfer learning for future applications.

Organizational Benefits

- Significantly reduce development time and resources required for building new image classification models.
- Leverage smaller datasets to achieve high-performance results, reducing the cost and effort of data collection and annotation.
- Implement robust models with improved accuracy for critical business operations, leading to better decision-making.
- Automate manual visual inspection tasks, improving efficiency and reducing human error across various departments.

- Empower teams to rapidly prototype and deploy AI-powered solutions for novel image-based problems.
- Efficiently utilize existing computational resources by adapting pre-trained, optimized models.
- Build a skilled workforce capable of developing and maintaining cutting-edge computer vision applications.
- Extract valuable insights from visual data, enabling more informed strategic planning and operational improvements.

Target Audience

1. Machine Learning Engineers
2. Data Scientists
3. AI Developers
4. Researchers
5. Software Engineers
6. Graduate Students Business Analysts
7. Anyone with a basic understanding of Python and machine learning concepts interested in practical deep learning applications.

Course Duration

Module 1: Introduction to Image Classification & Deep Learning

- What is Image Classification? Applications and challenges.
- Fundamentals of Machine Learning vs. Deep Learning.
- Introduction to Neural Networks and their architecture.
- Overview of Convolutional Neural Networks (CNNs).
- **Case Study:** Recognizing handwritten digits using a simple CNN (MNIST dataset).

Module 2: Understanding Transfer Learning

- The concept of transfer learning: Why and when to use it.
- Advantages of transfer learning: Speed, data efficiency, performance.
- Types of transfer learning: Inductive, Transductive, Unsupervised.
- Pre-trained models as knowledge reservoirs (e.g., ImageNet).
- **Case Study:** Explaining the concept of feature reuse using a simple image dataset (e.g., classifying cats vs. dogs using pre-trained features).

Module 3: Deep Learning Frameworks & Setup

- Introduction to TensorFlow/Keras and PyTorch.
- Setting up your deep learning environment (GPU acceleration).
- Data loading and preparation for image datasets.
- Basic image manipulation with libraries (PIL, OpenCV).
- **Case Study:** Configuring a Google Colab environment for deep learning, importing datasets.

Module 4: Exploring Popular Pre-trained Architectures (Part 1)

- VGGNet: Architecture, strengths, and limitations.
- ResNet: Residual connections and tackling vanishing gradients.
- Inception Networks: Multi-scale feature extraction.
- Understanding the trade-offs between model size and performance.

- **Case Study:** Comparing the feature extraction capabilities of VGG16 and ResNet50 on a small image dataset.

Module 5: Exploring Popular Pre-trained Architectures (Part 2)

- MobileNet: Efficient models for mobile and edge devices.
- EfficientNet: Compound scaling for optimized performance.
- DenseNet: Feature reuse through dense connectivity.
- When to choose a specific pre-trained model.
- **Case Study:** Applying MobileNetV2 for real-time object classification on a smartphone-captured dataset.

Module 6: Feature Extraction with Pre-trained Models

- Using pre-trained CNNs as fixed feature extractors.
- Removing the top classification layer.
- Adding a new classification head (Dense layers).
- Training only the new layers.
- **Case Study:** Building an image classifier for plant disease detection by extracting features from a pre-trained ResNet and training a new classifier.

Module 7: Fine-tuning Pre-trained Models

- Unfreezing specific layers for retraining.
- Setting different learning rates for different layers.
- Strategies for selective fine-tuning.
- Considerations for dataset size and similarity.
- **Case Study:** Fine-tuning the last few layers of an InceptionV3 model to classify different types of artwork.

Module 8: Data Preprocessing and Augmentation

- Image resizing, normalization, and standardization.
- Geometric transformations (rotation, flip, zoom).
- Color jittering and other photometric augmentations.
- Using ImageDataGenerator (Keras) or torchvision.transforms (PyTorch).
- **Case Study:** Enhancing a medical image dataset for tumor detection using aggressive data augmentation techniques.

Module 9: Model Training and Optimization

- Loss functions for image classification (e.g., Categorical Crossentropy).
- Optimizers: Adam, SGD with momentum, RMSprop.
- Learning rate schedulers and callbacks (ReduceLROnPlateau, EarlyStopping).
- Batch size and epoch considerations.
- **Case Study:** Optimizing the training process for a satellite image classification model to distinguish land cover types.

Module 10: Model Evaluation and Interpretation

- Accuracy, Precision, Recall, F1-score, and Confusion Matrix.
- ROC curves and AUC score.
- Interpreting model predictions and identifying misclassifications.
- Techniques for visualizing activations and feature maps.

- **Case Study:** Analyzing the performance of a facial emotion recognition model and identifying biases in misclassifications.

Module 11: Handling Imbalanced Datasets

- Understanding class imbalance and its impact.
- Resampling techniques (oversampling, undersampling).
- Using class weights in the loss function.
- Data augmentation for minority classes.
- **Case Study:** Developing an image classifier for rare animal species, addressing the challenge of limited samples for certain classes.

Module 12: Deployment Considerations & Best Practices

- Saving and loading trained models.
- Model compression and quantization for inference.
- Deployment strategies (local, cloud, edge devices).
- Version control for models and datasets.
- **Case Study:** Preparing and deploying a product defect detection model for real-time inference on a manufacturing assembly line.

Module 13: Advanced Transfer Learning Topics

- Self-supervised learning and its relation to transfer learning.
- Knowledge distillation for model compression.
- Few-shot learning with pre-trained models.
- Transfer learning in Generative Adversarial Networks (GANs).
- **Case Study:** Exploring how a pre-trained language model combined with image features can improve image captioning.

Module 14: Project Work & Real-World Applications

- Participants work on a real-world image classification project.
- Problem definition, data acquisition, model selection.
- Implementation, training, and evaluation.
- Presentation of results and discussion.
- **Case Study:** Building a custom image classifier for a specific industry problem (e.g., categorizing retail products, identifying anomalies in industrial equipment).

Module 15: Ethical Considerations & Future Trends

- Bias in AI models and ethical implications of image classification.
- Responsible AI development practices.
- Privacy concerns in visual data.
- Emerging trends in computer vision and transfer learning (e.g., Vision Transformers).
- **Case Study:** Discussing the ethical implications of using facial recognition models in public surveillance.

Training Methodology

This course adopts a **blended learning approach**, combining **interactive lectures** with extensive **hands-on coding exercises** and **project-based learning**.

- **Instructor-Led Sessions:** Engaging theoretical explanations, concept discussions, and live coding demonstrations.
- **Practical Labs:** Dedicated time for participants to apply learned concepts through guided coding exercises.
- **Real-world Case Studies:** In-depth analysis and implementation of industry-relevant scenarios.
- **Individual and Group Projects:** Opportunity for participants to work on a complete end-to-end image classification project.
- **Collaborative Learning:** Encouragement of peer-to-peer learning and problem-solving.
- **Q&A and Discussion Forums:** Dedicated time for clarifying doubts and fostering deeper understanding.
- **Resource Sharing:** Access to comprehensive course materials, code repositories, and curated reading lists.

Register as a group from 3 participants for a Discount

Send us an email: info@fineskilltrainingcenter.org or call *+254769199797*

Certification

Upon successful completion of this training, participants will be issued with a globally- recognized certificate.

Tailor-Made Course

We also offer tailor-made courses based on your needs.

Key Notes

a. The participant must be conversant with English.

b. Upon completion of training the participant will be issued with an Authorized Training Certificate

c. Course duration is flexible and the contents can be modified to fit any number of days.

d. The course fee includes facilitation training materials, 2 coffee breaks, buffet lunch and A Certificate upon successful completion of Training.

e. One-year post-training support Consultation and Coaching provided after the course.

f. Payment should be done at least a week before commence of the training, to Fineskill Training Center account, as indicated in the invoice so as to enable us prepare better for you.

Upcoming Scheduled Sessions

Start Date	End Date	Location	Price
23 Nov 2026	04 Dec 2026	Online	$2,000
23 Nov 2026	04 Dec 2026	Physical	$3,000
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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