Transfer Learning

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Introduction to Transfer Learning

- Transfer learning is a sophisticated approach in machine learning where knowledge gained from solving one problem is applied to a related problem, typically by transferring the learned features and parameters of a pre-trained model to a new task.

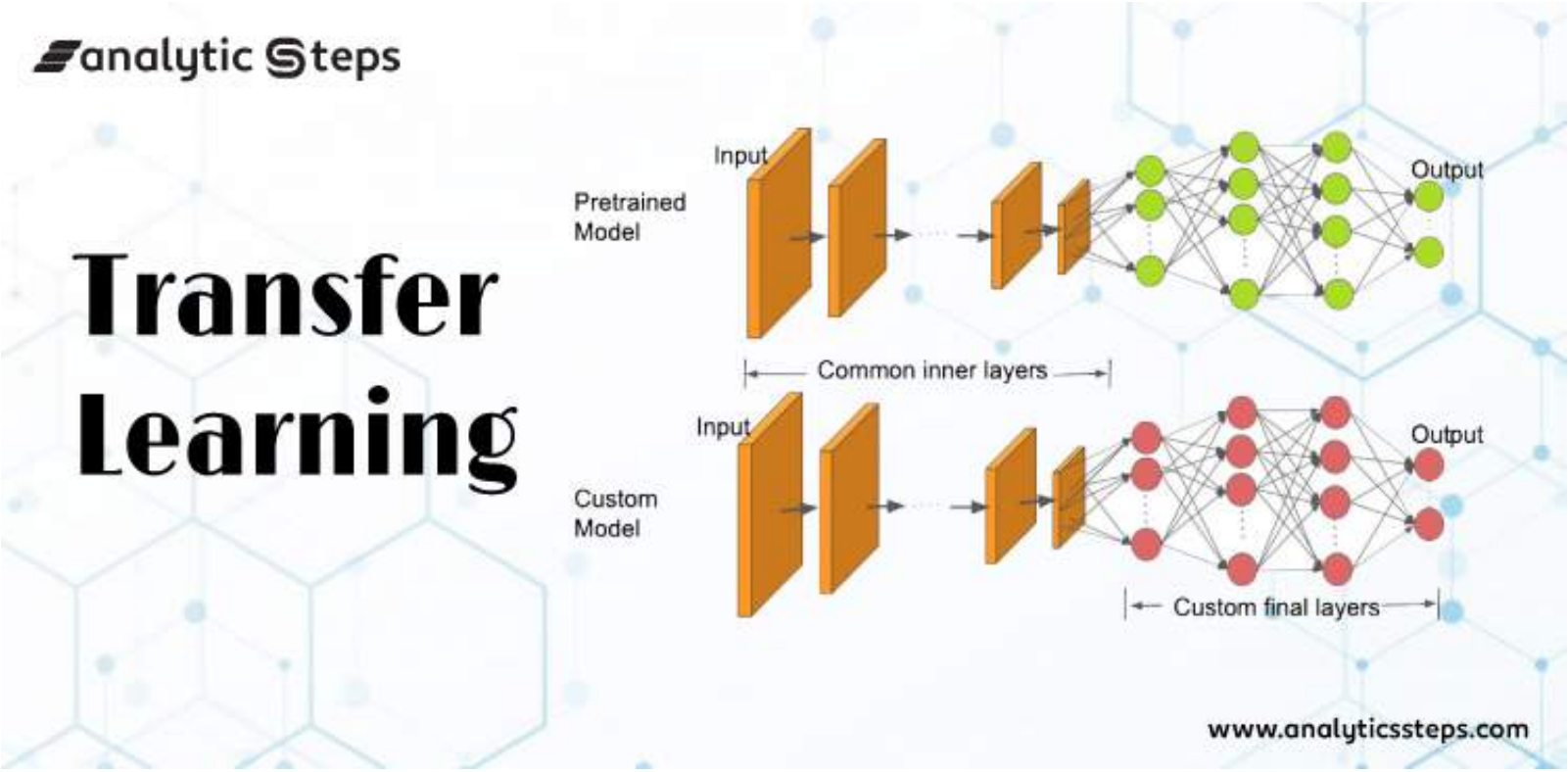
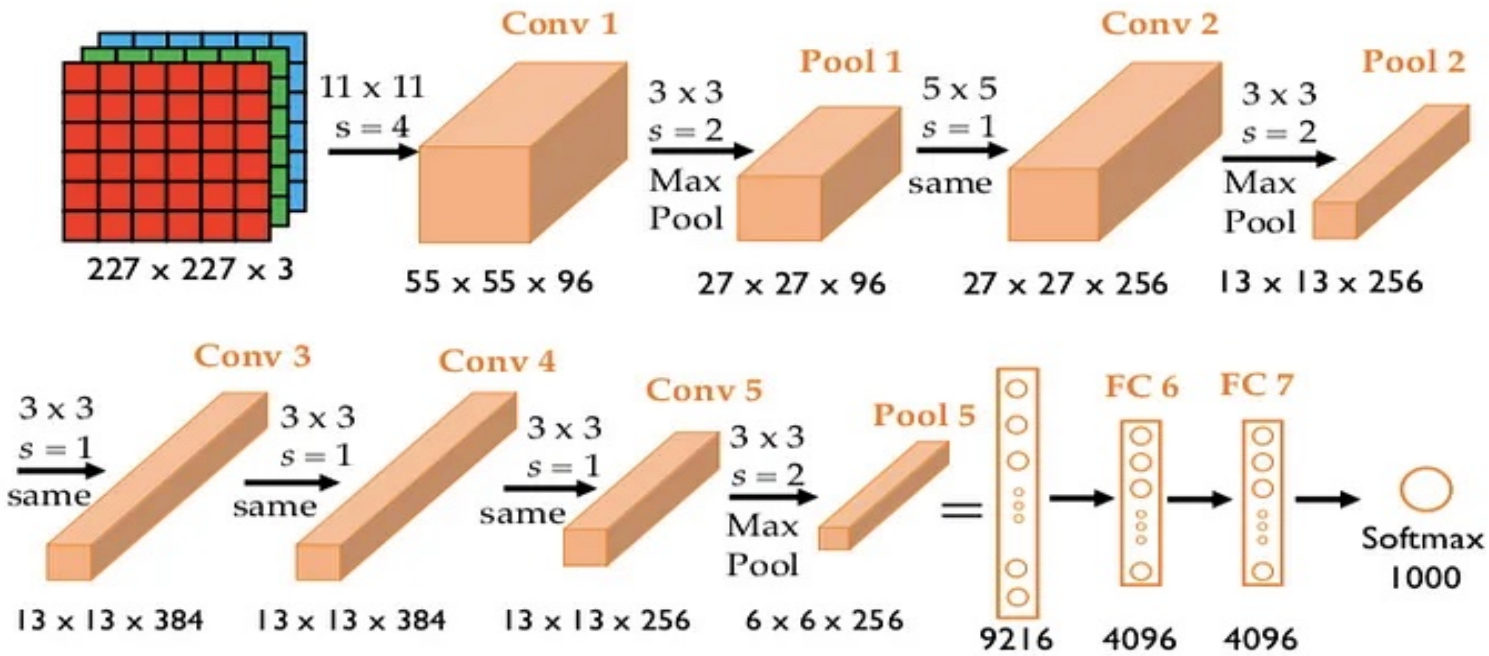


Figure: Transfer Learning

Technical Overview of AlexNet Architecture

- AlexNet is a pioneering convolutional neural network (CNN) architecture that revolutionized the field of computer vision, with 5 convolutional layers and 3 fully connected layers.
- The use of ReLU activation functions and dropout regularization helps prevent overfitting and improves model generalization.



Fashion MNIST Dataset Description

- The Fashion MNIST dataset is a collection of 70,000 grayscale images of clothing items belonging to ten different categories.
- Each image is of size 28x28 pixels, making it a suitable benchmark dataset for evaluating image classification algorithms.
- Each training and test example is assigned to one of the following labels:
  - 0 T-shirt/top
  - 1 Trouser
  - 2 Pullover
  - 3 Dress
  - 4 Coat
  - 5 Sandal
  - 6 Shirt
  - 7 Sneaker
  - 8 Bag
  - 9 Ankle boot

Implementation Steps for Transfer Learning I

1. Loading Pre-trained AlexNet Model
    1. We start by loading a pre-trained AlexNet model that has been trained on a large dataset such as ImageNet.
    2. Popular deep learning frameworks such as PyTorch or TensorFlow can be used to load the pre-trained model and its weights.
2. Feature Extraction
    1. Next, we modify the pre-trained AlexNet model by removing the last fully connected layers, which are specific to the original task (e.g., ImageNet classification).
    2. We retain the convolutional layers, which act as feature extractors, capturing low-level and high-level features from the input images. This is called "*freezing the input layers*".
3. Fine-tuning (Optional)
    1. Optionally, we can fine-tune the modified AlexNet model on the Fashion MNIST dataset by re-training some or all of its layers.

Implementation Steps for Transfer Learning II

2. Fine-tuning involves adjusting the model's parameters to better fit the new dataset while preserving the learned features from the pre-training phase.

4. Training and Evaluation
   1. We train the modified AlexNet model on the Fashion MNIST dataset using techniques such as mini-batch gradient descent and backpropagation.
   2. During training, we monitor performance metrics such as accuracy and loss to assess the model's convergence and generalization ability.
   3. After training, we evaluate the model's performance on a separate test set to validate its effectiveness.

Conclusion

1. Transfer learning using a pre-trained AlexNet model offers a powerful and efficient approach to tackle image classification tasks, even with limited labeled data.
2. By leveraging the learned features and parameters from the pre-trained model, we can expedite model training and achieve superior performance on the target task.

Thank You

Thank You!