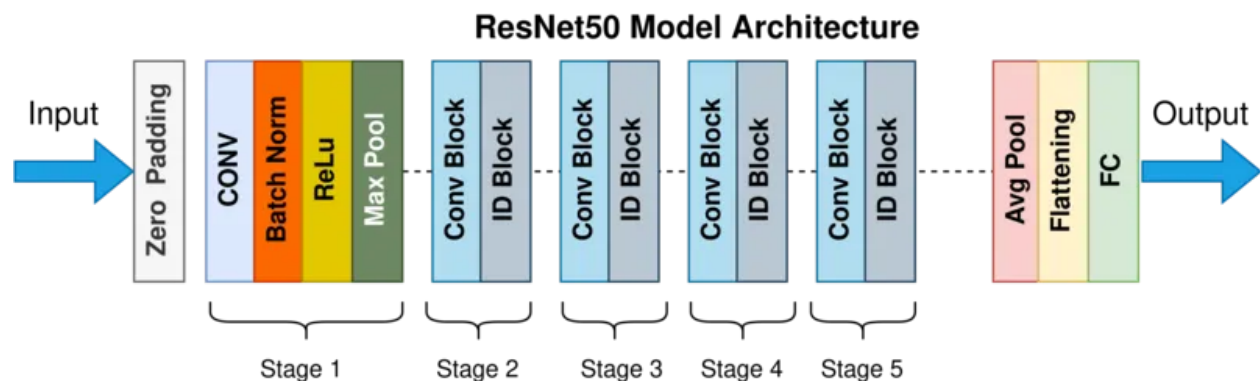


Image Classification using ResNet50 in TensorFlow/Keras

1. Introduction to the Model: ResNet50

ResNet50 (Residual Network with 50 layers) is a **deep convolutional neural network (CNN)** architecture introduced by Microsoft Research in the paper “*Deep Residual Learning for Image Recognition*” (He et al., 2015). It won the **ImageNet Large Scale Visual Recognition Challenge (ILSVRC) 2015**, achieving state-of-the-art accuracy by addressing the problem of vanishing gradients in deep networks.



ResNet50 Architecture

Key Characteristics of ResNet50:

- **Architecture:** 50-layer deep CNN
- **Core Innovation:** Use of **residual blocks** with **skip connections** that allow gradients to flow directly through the network

- **Input Shape:** 224x224 RGB images
- **Parameters:** ~25.6 million trainable parameters
- **Pre-trained Weights:** Trained on **ImageNet**, a dataset of over 1.2 million labeled images across 1,000 classes

2. Key Features of ResNet50

- **Residual Connections:** Help train very deep networks without vanishing gradient issues
- **High Accuracy:** Among the top-performing models for image classification
- **Transfer Learning Friendly:** Can be used as a backbone for many other vision tasks
- **Modular and Scalable:** Easily extendable to ResNet101, ResNet152, etc.
- **ImageNet Pretrained:** Works out-of-the-box for thousands of real-world classes

3. Use Cases

| Domain | Use Case |
|------------|--|
| Healthcare | Detecting diseases from X-rays or skin lesion images |
| Retail | Product recognition and inventory management |
| Wildlife | Species identification from camera trap images |

| | |
|-----------|--|
| Security | Object/person identification from surveillance footage |
| Education | Teaching and research in deep learning and computer vision |

4. Implementation Summary

Step-by-Step Notebook Breakdown:

| Step | Description |
|--------------------------------|--|
| 1. Import Dependencies | TensorFlow Keras modules, preprocessing tools, matplotlib for image display |
| 2. Load Model | ResNet50 is loaded with pretrained ImageNet weights |
| 3. Image Preprocessing | Image is resized to 224x224, converted to array, batch dimension added, and preprocessed |
| 4. Prediction | Model is used to predict the class probabilities for the input image |
| 5. Decoding Predictions | Top-3 predictions are decoded and printed in human-readable labels |
| 6. Display Image | Image is displayed using Matplotlib for visual confirmation |

Example Output (elephant.jpg):

yaml

CopyEdit

1. African_elephant: 87.34%
2. Indian_elephant: 11.02%
3. tusker: 1.38%

5. Conclusion

ResNet50 remains one of the most reliable and efficient deep learning models for image classification. Its deep residual learning framework enables training of very deep networks with high accuracy. With pre-trained weights and easy integration into TensorFlow/Keras, it offers excellent performance for a wide range of image-based tasks — even with minimal coding and resources.

By leveraging ResNet50 with just a few lines of code, you can accurately classify and recognize objects in images — a powerful first step into more complex computer vision applications.

6. References

1. [Deep Residual Learning for Image Recognition](#)
2. [ImageNet Project](#)
3. ImageSource:
https://miro.medium.com/v2/resize:fit:1100/format:webp/1*VM94wVftxP7wkiKo4BjfLA.png