



RESEARCH PROPOSAL

Comparative Analysis of Image Classification Models for Efficient and Accurate Classification across Diverse Image Types

Student: Yusif Mukhtarov

Date: 05/30/2023

Image classification is a fundamental task in computer vision that involves categorizing images into predefined classes or labels. With the exponential growth of digital imagery in various domains, such as medical imaging, autonomous vehicles, etc. Nowadays, there is an increasing demand for robust and efficient image classification models. The objective of this research is to conduct a comprehensive comparative analysis of different image classification models to identify the best models in terms of time and accuracy for different types of images.

Following models will be compared and tested on different datasets:

1. Lenet-5
2. VGG16
3. AlexNet
4. EfficientNet
5. ResNet50
6. MobileNet (not only accuracy, but time will also be considered as evaluation metrics of models)

Depending on number of successful tested analyses of listed above models and considering the limited time of project additional popular models can be also tested:

1. BASIC-L
2. ViT-L/16
3. CoCa

All those models will be compared on various datasets. Those datasets can be divided into two types:

a) Image types

1. Small images: Images with dimensions such as 32x32, 64x64, or 128x128 pixels. Small images can pose a challenge as they contain less visual information, so choosing a model that can capture fine-grained details efficiently is important.
2. Large images: Images with high-resolution and larger dimensions, such as 512x512 or 1024x1024 pixels. Large images typically contain more detailed information and may require models that can handle increased computational and memory requirements.
3. Low-resolution images: Images with reduced image quality, typically resulting in blurred or pixelated visuals. These images may require models that can extract meaningful features even with limited details.
4. High-resolution images: Images with very high-quality and fine details, often having dimensions exceeding 1024x1024 pixels. These images demand models capable of handling large input sizes and capturing intricate features accurately.
5. Noisy images: Images with added noise, such as Gaussian noise or salt-and-pepper noise. These images can simulate real-world scenarios where images may have imperfections, and models that are robust to noise can be evaluated.
6. Occluded images: Images where objects of interest are partially obscured by other objects. Occlusions can pose challenges in correctly classifying objects, so evaluating models on occluded images can provide insights into their ability to handle such situations.
7. Augmented images: Images generated by applying various data augmentation techniques such as rotation, translation, scaling, flipping, or adding random distortions. Augmented images can help evaluate the model's ability to generalize well and handle variations in the input data.

b) Popular Image datasets:

1. ImageNet
2. CIFAR-10
3. ObjectNet

Datasets from this list can be replaced (medical images might also be considered, the only problem is accessibility of data) and dropped out depending on accessibility of those datasets and computational power to process them. Indeed, accessibility and computational power are the only issues that can be listed in the beginning of the project, however, there might be more problems that will be faced during the research project.

Considering the importance of image classification in computer vision realm there is a great list of domains people and companies from which will benefit from this work. So based on the outcome of our research appropriate models will be selected for those classifications:

1. Medical Imaging: Image classification models can be used in medical imaging to classify different types of medical images, such as X-rays, MRI scans, CT scans, and histopathology images. Accurate classification can aid in the diagnosis of diseases, detection of abnormalities, and identification of specific medical conditions.
2. Remote Sensing: Image classification is crucial in remote sensing applications, where satellite or aerial imagery is analyzed to classify land cover, vegetation types, urban areas, water bodies, and other geographical features. Accurate classification in remote sensing can support environmental monitoring, disaster management, and urban planning.
3. Security and Surveillance: Image classification plays a vital role in security and surveillance systems. It can be used to classify and identify objects, individuals, or activities captured by CCTV cameras or other surveillance devices. Accurate classification can aid in detecting suspicious behavior, recognizing faces, and identifying potential security threats.
4. E-commerce and Retail: In e-commerce and retail industries, image classification is used for various purposes, including product classification, visual search, and recommendation systems. Accurate classification can improve product categorization, enable better search results, and enhance personalized recommendations for customers.
5. Autonomous Vehicles: Image classification is essential for autonomous vehicles to perceive and interpret their surroundings. Classification models can identify objects such as pedestrians, vehicles, traffic signs, and road markings from camera feeds. Accurate classification is crucial for safe and reliable autonomous driving.

Taking into account the period of the project (11 months) the final result should include at least testing of 6 models on 4 different data types, and in midterm result comparison of 3 models on 2 different data types. However, if time is allocated appropriately, more models will be analyzed on even wider range of data types.