Deep Learning Course Project
Blood Cell Classification Using Transfer Learning

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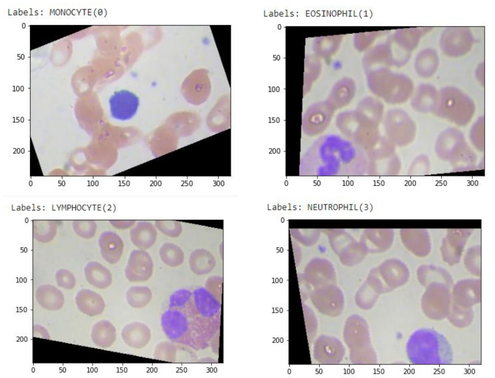
Abstract

- Identifying and categorising patient blood samples is a common part of diagnosing blood-based disorders.
- In the research of benign and malignant hematologic illnesses, accurate identification of peripheral blood components and distinct leukocyte subsets is critical.
- Laboratory technicians' everyday routine activity includes the identification of normal blood components and the classification of white blood cells. Automation of this process would save up time for more difficult tasks.

Dataset & Preprocessing

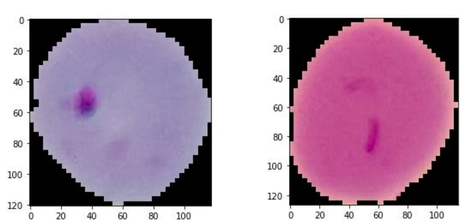
Dataset-1

- Contains 12,500 augmented images of blood cells (JPEG) with accompanying cell type labels (CSV).
- grouped into 4 different cell types
- approximately 3,000 images per class



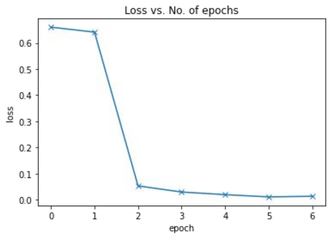
Dataset-2

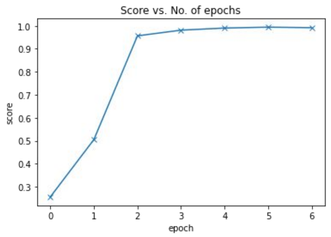
- Contains 2 folders: Infected & Uninfected
- Total of 27,558 images.

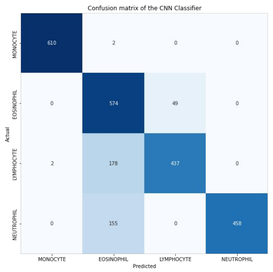


Models

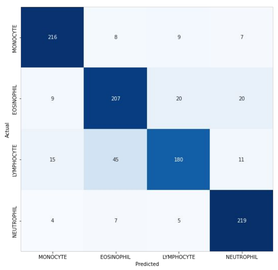
1. A **convolutional neural network (CNN)**-based 4 class classification model was applied with Batchnorm and the following results were obtained and the accuracy reported was



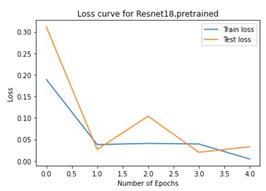


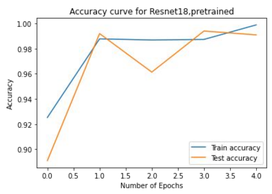


2. **Feature Extraction**: Resnet50 Architecture pre-trained on Imagenet Dataset was used to extract the features from the given dataset and SVM One Vs One classifier was trained that gave us accuracy of 83.71 percent

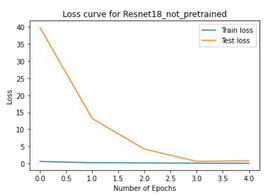


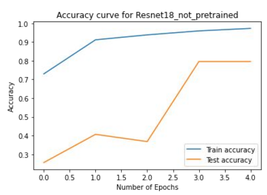
3. **Transfer Learning with Resnet 18** : Pretrained Resnet-18 Model was trained giving us the best Testing Accuracy of 99.08 and a Training Accuracy of 99.87.



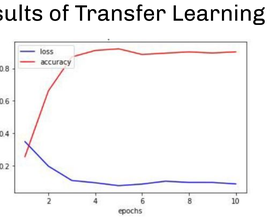


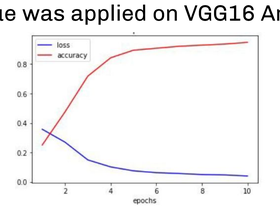
4. **Training from Scratch on Resnet 18**: There was clearly overfitting proving that if the dataset size is not big enough Transfer Learning is the better option



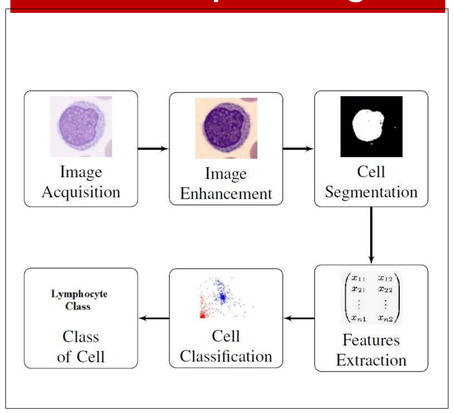


5. **VGG-** Results of Transfer Learning technique was applied on VGG16 Architecture:



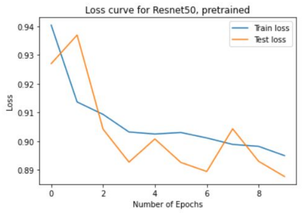


Data Preprocessing



Malaria Detection

- The Models were also run on the Malaria dataset, when a person is infected with malaria there is some change in his blood cells and an automated method is helpful in his case
- Application of Transfer Learning on Resnet50 pretrained model gave an accuracy of 85.16%
- The loss curve obtained on the dataset is as follows:



Future Work

- We can extend the analysis and the models used to identify other cell-related defects or diseases in which Blood cells or any other cells for that matter get affected eg. anemia, leukopenia detection.
- Using Transfer Learning we can even think of using the knowledge obtained in blood cell classification task to investigate cell defects

Conclusion

- Transfer Learning and Feature Extraction Techniques are better approaches for training the networks when it comes to medical image classification as the dataset available is usually less, and that can be seen from the results as well as
- In the case of Feature extraction and TransfeLearning the Training Accuracy was closer to Testing Accuracy while the same was not the case in training from scratch as the model was overfitting.
- Also since both the dataset the cell classification and Malaria Detection(Binary Classification) were the same the Models that worked for one worked for the other as well.

References

- https://drive.google.com/drive/folders/1uHy5qn2H-tBTXjW4ZgozqgKJsN6PvhS-?usp=sharing
- https://www.kaggle.com/datasets/paultimothymooney/blood-cells
- https://www.kaggle.com/datasets/iarunava/cell-images-for-detecting-malaria
- https://jovian.ai/iloncka/blood-cell-classification-fork-from-simple-cnn-starter#C2
- https://jovian.ai/iloncka/blood-cell-classification-supplement-densenet121-training
- https://cs230.stanford.edu/projects_spring_2018/reports/8290365.pdf