Assignment Report

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Study and Experiments on Neural Networks and Clustering

Introduction

In this report, we present a comprehensive analysis of our study and experiments involving the classification of bee and ant images using neural networks and clustering techniques. Our focus includes optimizing the learning rate, utilizing the ResNet-18 architecture for feature extraction, and evaluating the performance of different classification models.

Dataset and Preprocessing

The dataset consists of images categorized into two classes: bees and ants. To prepare the data, we applied data augmentation techniques for training, including random resized cropping and horizontal flipping. Normalization was performed on both training and validation data to standardize pixel values.

Neural Network Feature Extraction

We adopted the ResNet-18 neural network architecture pretrained on a large dataset. To extract features, we removed the final fully connected layer and passed the images through the network. The obtained feature vectors were used as input for classification.

Model Training and Evaluation

We employed three classification models for comparison:

- L2 Regularized Logistic Regression
- RBF Kernel Support Vector Machine (SVM)
- Random Forest

Hyperparameter tuning was carried out for SVM and random forest using GridSearchCV. The models were trained on the extracted ResNet-18 features.

Results and Analysis

L2 Regularized Logistic Regression

The logistic regression model achieved an accuracy and F1-score of approximately 60

RBF Kernel SVM

The RBF kernel SVM exhibited slightly higher accuracy and F1-score, reaching around 61

Random Forest

The random forest model achieved the lowest accuracy and F1-score, around 59

Conclusion

In conclusion, our study demonstrates the complexity of image classification tasks involving bee and ant images. While the achieved accuracies and F1-scores are modest, they highlight the challenges posed by intricate image features. Further exploration of advanced neural network architectures, preprocessing techniques, and ensemble methods could enhance performance.