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## Image Classification using SVM

### **Introduction**

In this lab, I had the opportunity to implement a Support Vector Machine (SVM) for classifying images using the CIFAR-10 dataset. We focused on three classes specifically that were cats, dogs, and ships. SVM works by finding the optimal boundary between different categories. I gained a better understanding of how SVM relies on support vector and how this helps in accurately classifying the data.

### **Understanding SVM's**

I learned that SVM is a supervised machine learning algorithm primarily used for classification tasks. It works by finding a hyperplane that best separates the classes in the feature space. I found it intriguing to see how the model uses support vectors, which are data points nearest to the hyperplane that affect its placement. This concept made me appreciate the importance of each data point on the classification process.

### **Data Exploration and Preparation**

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This first step involved loading the CIFAR-10 dataset. Since we were working with a large dataset, filtering it down to just three classes was essential. The provided code simplified this process. Converting the images to grayscale also reduced computational demands. I realized how crucial preprocessing is in preparing data for training.

### **Model Training and Evaluation**

After preprocessing, I trained the SVM model using the SVC function from Scikit-learn with a linear kernel. This training process was seamless due to the provided code. However, I learned that the choice of kernel is vital; while a linear kernel is effective for certain datasets, it may not always be the best fit for more complex ones. Evaluating model was equally important. I made predictions on the test set and assessed performance using accuracy. While the model showed decent results, it struggled with visually similar classes, highlighting SVM's limitations.

### **Challenges Faced:**

One challenge I faced was grasping the impact of normalization and flattening images. Although I saw how these steps improved model performance, understanding necessity took time. Visualizing images at different stages, including

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original, grayscale, and normalized, further reinforced my understanding of the impact of preprocessing.

## **Conclusion**

This lab provided a solid introduction to SVM and image classification. It emphasized the importance of model limitations and the need for careful preprocessing. I am excited to explore more advanced techniques, like convolutional neural networks, to enhance classification accuracy in future projects.

## **References**

- Scikit-learn Developers. (n.d.). Support vector machines.  
<https://scikitlearn.org/stable/modules/svm.html>
- GeeksforGeeks. (n.d.). *Support vector machine algorithm*.  
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