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Link to CIFAR-10 dataset

https://colab.research.google.com/drive/12HgmO0YuZCxp3na_dHw4C2fP8jYvMHSd#scrollTo=4Hu23TetMsfL

Reflective Journal: SVM for Image Classification

First Impressions

Initial Thoughts:

When I first encountered the task of using a Support Vector Machine (SVM) for image classification, I felt both excited and slightly intimidated. The idea of working with a well-known dataset like CIFAR-10 was exciting, but I was unsure about how well SVM, a relatively simple algorithm compared to neural networks, would perform on a complex task like image classification.

Prior Knowledge & Approach:

I had prior knowledge of image classification and machine learning from previous courses, but I hadn't specifically applied SVM to image data. This prior exposure gave me a foundation, but I knew I'd need to adapt my understanding for this specific algorithm, particularly with the preprocessing steps like converting images to grayscale and flattening them.

Learning Process

Working Through the Notebook:

Initially, loading and visualizing the dataset was straightforward. I felt confident with these steps as they were well explained and familiar from other exercises. However, when it came to preparing the data for the SVM (converting to grayscale, flattening), I had to slow down and consider why these steps were necessary. Understanding the rationale—such as why SVM requires a 1D feature vector—helped me proceed with confidence.

Challenges and Breakthroughs:

The most challenging concept was understanding how SVM, which is typically a binary classifier, would handle multiclass classification. The notebook's use of the one-vs-rest strategy was initially confusing, but after reviewing the explanation and some external resources, I had an "aha!" moment when I realized that each classifier independently handles one class against all others.

Resources and Assistance:

I did seek out additional resources, particularly on how SVM works with multiclass classification. Online tutorials and documentation from scikit-learn were very helpful in solidifying this understanding. Additionally, experimenting with the code helped me see the theory in action.

Challenges and Triumphs

Difficulties Encountered:

One of the biggest challenges I faced was the high computational demand of SVM on the CIFAR-10 dataset. Training the SVM on even a reduced set of images took much longer than I anticipated. To overcome this, I worked with a subset of the dataset and simplified the problem, which made it more manageable.

Rewarding Moments:

One of the most rewarding moments was when I successfully made predictions using the trained SVM model. Even though the accuracy wasn't as high as I'd hoped, seeing the model classify images correctly felt like a significant achievement. Visualizing the predicted labels alongside the true labels was particularly satisfying because it made the abstract process of machine learning tangible.

Mistakes and Lessons:

At one point, I mistakenly applied the SVM to the raw RGB images without converting them to grayscale. This resulted in very slow training times and poor accuracy. Realizing the importance of data preprocessing in improving model performance was a valuable lesson.

Personal Growth

Understanding of Image Classification & ML:

This exercise deepened my understanding of image classification, particularly with non-deep learning algorithms like SVM. I now appreciate that, while SVM can be useful for simpler datasets, it may struggle with more complex image data like CIFAR-10, which is better suited for convolutional neural networks (CNNs).

Skills and Knowledge Gained:

I've gained practical experience in preparing image data for traditional machine learning algorithms, learned how to apply SVM to multiclass problems, and become more comfortable evaluating model performance. Additionally, I now have a clearer understanding of the trade-offs between simplicity and computational power in machine learning models.

Confidence in Applying SVM:

While I feel more confident in my ability to apply SVM to basic image classification tasks, I understand that SVM has limitations with large, high-dimensional datasets like CIFAR-10. For smaller or more defined image sets, I could apply SVM with greater ease.

Looking Ahead

Remaining Questions:

After completing this exercise, I'm curious about how SVM compares to other machine learning algorithms in terms of both speed and accuracy for image classification tasks. I would also like to explore kernel tricks in SVM to see if they could improve performance on more complex data like CIFAR-10.

Future Learning:

I'm eager to dive deeper into deep learning techniques, particularly convolutional neural networks (CNNs), as I can now see their advantage over traditional algorithms like SVM in handling image data. I'm also interested in exploring unsupervised learning techniques in the future, particularly how they can be used in image clustering and feature extraction.

Application in Studies and Career:

What I've learned here will be directly applicable to my ongoing studies and future career in machine learning. Understanding how to evaluate and choose the right algorithm for different tasks will be crucial in any real-world application, especially in fields like autonomous vehicles or computer vision.