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When and how to use classical Machine Learning for Computer Vision

1 min read

Classical machine learning algorithms can still be useful for certain computer vision tasks, despite the rise of deep learning. According to experts, scenarios where classical techniques may be preferred include those with limited training data, computational constraints, need for interpretability, or relatively simple problems.

When to Use Classical ML

Classical machine learning algorithms like support vector machines (SVM) or random forests can outperform deep learning models when dealing with small datasets, as they typically require less training data. These algorithms are also generally faster and less computationally intensive during both training and inference, making them suitable for applications with limited resources or real-time requirements. Moreover, some classical algorithms, such as decision trees or linear models, offer better interpretability compared to deep neural networks, allowing for easier understanding of the decision-making process and extraction of insights from the model.

Key Scenarios for Classical ML

Classical machine learning techniques can be effective for computer vision tasks in controlled environments or when dealing with relatively simple problems like basic image classification or object detection. For instance, if domain knowledge is available, carefully engineered hand-crafted features extracted from images can sometimes outperform automatically learned features from deep learning models.

- Classical algorithms are often easier to implement than deep learning models for straightforward vision tasks.

- They can be sufficient when computational resources are limited, as they are generally faster and less computationally intensive compared to deep learning approaches.

Steps for Classical ML in Vision

To use classical machine learning for computer vision tasks, you typically follow these steps:

- Preprocess the data by resizing, normalizing, or converting the images to a suitable format for the chosen algorithm.
- Extract relevant features from the images using techniques like edge detection, corner detection, texture analysis, or color histograms. Domain knowledge can guide the selection of appropriate features.
- Convert the extracted features into a numerical representation, such as a feature vector, that is suitable for the machine learning algorithm.
- Train the chosen classical algorithm (e.g., SVM, random forest, logistic regression) on the encoded feature vectors and corresponding labels.
- Evaluate the trained model's performance on a separate test set and fine-tune the algorithm or feature extraction process if necessary.
- Deploy the trained model for inference on new, unseen images.

Hybrid Approaches in Vision

While classical machine learning techniques can be effective in certain scenarios, combining them with deep learning in hybrid approaches can sometimes yield improved performance or address specific limitations of either approach. For example:

- Traditional computer vision techniques can be utilized to improve deep learning performance in emerging fields such as SLAM, panoramic stitching, geometric deep learning, and 3D vision where deep learning is not yet well-established.
- Hybrid methods that combine deep learning with traditional algorithms can reduce training time, processing requirements, and data needs in a wide range of applications.

By leveraging the strengths of both classical machine learning and deep learning, these innovative hybrid techniques are driving exciting breakthroughs in the field of computer vision.

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