

Part A

Introduction

The use of data augmentation is indispensable in the field of computer vision and in deep learning in particular. It involves generating new training samples from old ones by applying different transformations that keep the data labels intact. The aim is to enrich training datasets with greater variety and volume, an act that plays an important role in the development of robust, high-performance deep learning models, since they are robust and less prone to overfitting.

Important events in the field of computer vision

There have been many milestones in the evolution of computer vision since its inception. The advent of convolutional neural networks (CNNs) revolutionized the field of computer vision, enabling machines to interpret images with far greater accuracy than had previously been imagined. The contribution of large image datasets such as ImageNet has likewise made great strides forward. These datasets are brimming with a wealth of labeled images, providing anyone with a large quantity of data available for training and testing purposes.

Importance of data enhancement

Preventing overfitting is important in computer vision models: it happens when a model works well on training data but fails on new data, and the aim of data augmentation is to help such models. By artificially increasing the size of the training set, data augmentation helps models learn more general features through additional methods.

Data augmentation techniques

Common data augmentation techniques in computer vision include

- Flipping: Mirroring horizontal or vertical images.
- Rotation: Rotating images by a certain angle.
- Scaling: Resize images by zooming in or out.
- Crop: Cut out parts of an image.
- Color jiggling: modify colors by adjusting brightness, contrast, saturation and hue.

Recent advances

Recent advances in data augmentation techniques have introduced more sophisticated methods such as :

- Clipping: Random removal of image sections.
- Blending: Weighted combination of image pairs and their labels.
- AutoAugment: Automatic discovery of augmentation policies that best improve the performance of a given model.

These techniques contribute to model robustness by presenting a wider variety of scenarios during training, improving the model's ability to generalize to new data.

Computer vision applications

Data augmentation is crucial in object detection and image segmentation. YOLOv4's "bag of freebies" includes a set of free data augmentation techniques that significantly improve pattern detection performance without increasing computational costs. The new YOLOv9 version further optimizes performance with features such as Programmable Gradient Information (PGI) and Generalized Efficient Layer Aggregation Network (GELAN), setting new benchmarks in real-time applications.

Platforms such as Roboflow streamline the development of computer vision solutions, offering tools for dataset creation, model training and large-scale deployment. Their automated labeling and model deployment functions facilitate rapid development and innovation in this field.

Recent articles

Recent articles have demonstrated the effectiveness of data augmentation in achieving state-of-the-art results. A comprehensive review by Kumar et al. provides an overview of data augmentation approaches and their impact on computer vision tasks. Another study explores the effectiveness of data augmentation in image classification using deep learning, highlighting the potential of generative adversarial networks (GANs) to generate new images for training.

In conclusion, data augmentation is an indispensable tool in the arsenal of computer vision practitioners, enabling the development of models that are not only accurate but also resilient to the variability inherent in real-world visual data. Proper implementation of data augmentation strategies is essential to advance the field and achieve breakthroughs in a variety of computer vision applications.

References

1. [T. Kumar, A. Mileo, R. Brennan, and M. Bendechache, "Image Data Augmentation Approaches: A Comprehensive Survey and Future Directions," *arXiv preprint arXiv:2301.02830*, 2023.](#)
2. [L. Perez and J. Wang, "The Effectiveness of Data Augmentation in Image Classification using Deep Learning," *arXiv preprint arXiv:1712.04621*, 2017.](#)
3. [A. Mumuni, F. Mumuni, and N. K. Gerrar, "A survey of synthetic data augmentation methods in computer vision," *arXiv preprint arXiv:2403.10075*, 2024.](#)
4. [B. Zoph, E. D. Cubuk, G. Ghiasi, T.-Y. Lin, J. Shlens, and Q. V. Le, "Learning Data Augmentation Strategies for Object Detection," *arXiv preprint arXiv:1906.11172*, 2019.](#)
5. [Boesch, G. \(2024\). YOLOv9: Advancements in Real-time Object Detection \(2024\).](#)