Master's Thesis

Cluster-Based Downsampling of Image and Video Data

Fachhochschule Südwestfalen
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Motivation

The increasing use of Artificial Intelligence in image and video processing is driving growing demands for computational power, memory, and energy. Efficient methods are needed to reduce large amounts of visual data while preserving their essential structural properties.

Clustering offers a promising approach to extracting relevant structures from image and video data, potentially enabling efficient downsampling and compression while reducing the computational demands of subsequent machine learning applications.

blueAIC develops Online Machine Learning technologies aimed at reducing the resource demands of AI applications. Based on its adaptive clustering algorithm CellStream, blueAIC is exploring new approaches to structure-preserving downsampling. This master's thesis will investigate their potential for image and video processing and evaluate their impact on subsequent computer vision applications.

Tasks

- **Literature review:** Identify relevant state-of-the-art methods for image and video clustering, downsampling, and compression.
- **Method development:** Investigate suitable representations of image and video data for CellStream-based clustering and develop approaches for structure-preserving downsampling.
- **Benchmark design:** Select representative datasets, computer vision applications, and evaluation metrics.
- **Experimental evaluation:** Evaluate CellStream-based approaches in terms of data reduction, computational efficiency, structural preservation, compression potential, and subsequent machine learning performance.

Requirements

- Master's student in Digital Technologies or Systems Engineering & Engineering Management
- Good programming skills in Python
- Solid knowledge of Machine Learning and data analysis
- Initial experience with computer vision and ML frameworks such as OpenCV, PyTorch, or MLPro

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