PÔSTER - RESUMO - SENSORES E BIOSSENSORES

AI FRAMEWORK TO SELECT ROBUST CONVOLUTED NEURAL NETWORKS FOR SENSOR DATA

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Selecting the optimal convolutional neural network (CNN) backbone is critical for task-specific imaging techniques such as sensor data processing, medical imaging, remote sensing, and others. CNNs are specialized deep learning algorithms that are inspired by the visual cortex found in animal brains. They use automated filter optimization to process grid-like visual data and extract spatial features like textures and shapes. When deploying pre-trained CNNs, they efficiently extract features from sensor images, which can then be used to train classifiers specific to a given task. However, finding the best CNN backbone relies on exhaustive empirical testing and is often labor-intensive [1].

We propose a novel backbone selection framework that repurposes reinforcement learning (RL) agents as diagnostic probes of CNN feature quality. Our method deploys RL agents that learn to manipulate images of one class such that their CNN features become less distinguishable from those of another class. The central idea is that the learning performance of the RL agent serves as a metric for the representation quality of the backbone: A backbone whose features are more easily manipulated by the RL agent fails to encode the features robustly.

To validate our approach, we benchmark it against an existing study that manually evaluates different CNN backbones for the classification of lung diseases from X-ray images [2]. Our method produces a comparable ranking of backbone quality while demonstrating superiority by fully automating and generalizing the selection process, effectively eliminating the need for labor-intensive manual evaluation. Furthermore, we apply our framework to a dataset of blood screening images to propose a suitable and robust CNN backbone for detecting PCA proteins, a biomarker used in prostate cancer screening [3].

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Palavras-chave: convolutional neural networks; machine learning; sensor data; image recognition; reinforcement learning.