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Discriminative Open Set Active Learning (DOSAL)

Active learning is commonly framed in the artificial intelligence community as a strategy to reduce labeling costs by selectively querying informative samples for model improvement, yet its conceptual roots are closely aligned with classical ideas from statistical design of experiments, particularly sequential design and design augmentation. In this work, we position active learning as a modern instantiation of experimental design under evolving data representations, where the design space itself is learned rather than predefined. We introduce DOSAL, a discriminative open set active learning framework that bridges statistical design principles with deep learning–based representation learning. Starting from a convolutional neural network (CNN) trained on known classes, learned latent representations are treated as empirical feature spaces in which sample utility can be quantified. DOSAL combines novelty, measured through distances in feature space, and surprisal, derived from discriminative probability estimates, into a unified acquisition strategy that parallels multi-criterion optimality in experimental design. This strategy is used to iteratively augment the training set whilst accounting for open set conditions, where previously unseen classes may be present. In this way, DOSAL provides an explicit and operational connection between classical design-based sample selection and modern neural representations, enabling discovery-oriented learning driven by design-inspired criteria rather than purely heuristic querying. The working principles of DOSAL will be outlined during the presentation, and its empirical behavior relative to baseline methods are demonstrated on a benchmark dataset.

Special/ Invited session

Bridging AI and statistics / Bart De Ketelaere

Classification

Both methodology and application

Keywords

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