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Research Abstracts

Cross-Dataset Adaptation for Instrument Classification in Cataract Surgery Videos

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Introduction: In the context of surgical analysis, detecting the presence of surgical tools is vital for evaluating surgeries both during and after the procedure. However, existing state-of-the-art models that excel on one dataset often struggle when applied to another for the same task. This is due to significant differences between datasets caused by variations in tools, sensors, and data resolution, termed as domain shift.

Methods: To tackle this issue in cataract surgeries, we introduce a new technique called the Barlow Adaptor - an end-to-end unsupervised domain adaptation (UDA) method that effectively addresses distribution shifts between datasets without requiring labeled data from the target domain. In addition, we introduce a novel loss function called the Barlow Feature Alignment Loss(BFAL) as a key component of our approach. BFAL not only aligns features across diverse domains but also minimizes redundancy, enhancing cross-dataset performance without the need for larger batch sizes. Thus, BFAL represents a fresh perspective in mitigating domain shift challenges in cataract surgery data.

Results: We conducted extensive experiments using two cataract surgery datasets, demonstrating the superiority of our proposed method. Our approach surpasses existing state-of-the-art UDA methods by 6%, underscoring its effectiveness in addressing domain shift challenges in surgical data.

Conclusions: Domain shift is a common issue faced by models when trained and tested on data from different sources. In this approach, we highlight this effect for surgical data and introduce a novel approach called Barlow Adaptor that improves significantly upon existing methods for surgical instrument classification.