ARIA
APPLIED RESEARCH IN ACTION

Efficient Embedding-Based Item Identification for Robotic Pick and Place Applications

Transforming Item Identification in Robot-Assisted Grocery Fulfillment: An Embedding-Driven Solution for Precision and Efficiency
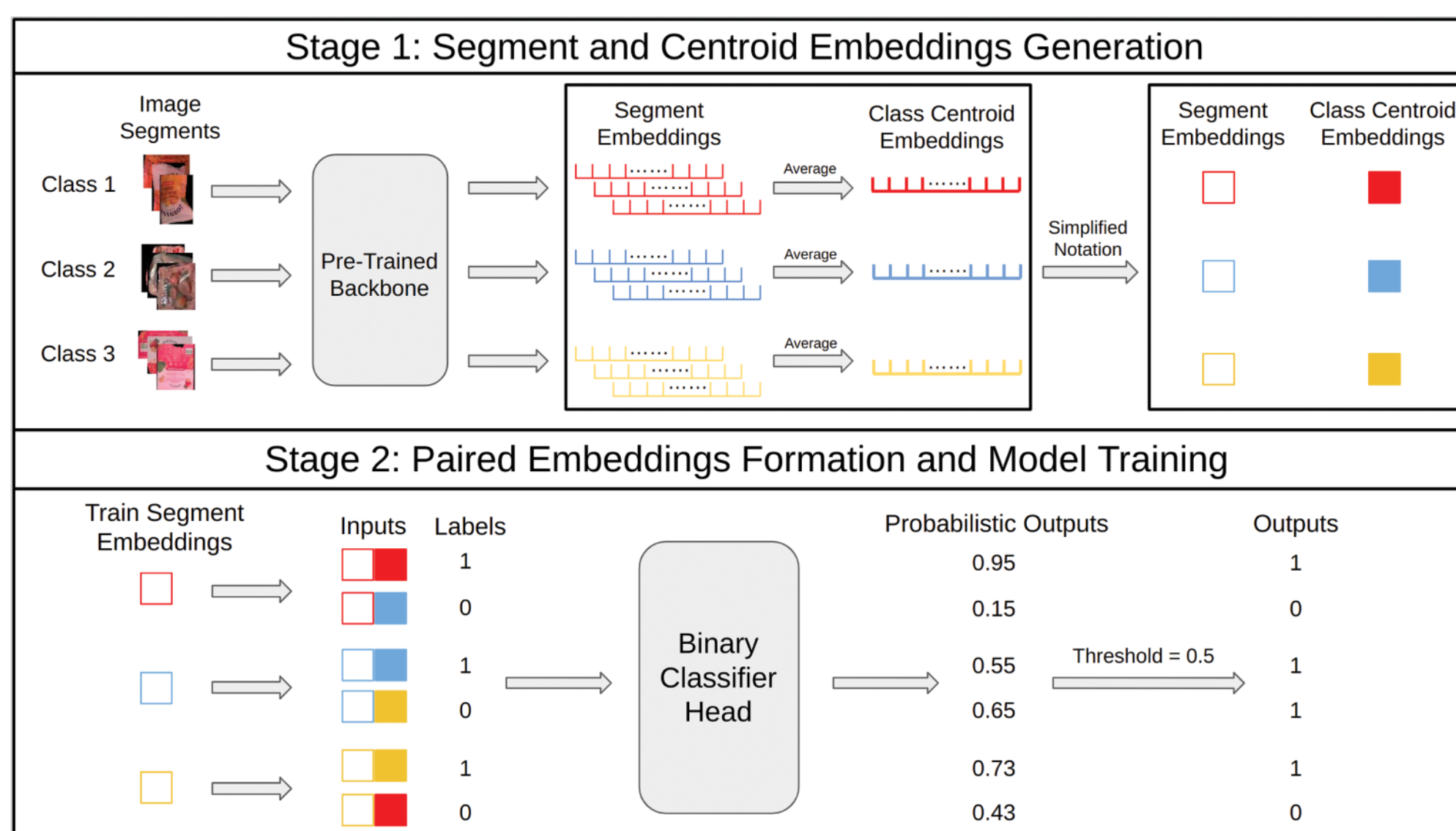
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	Easy	Medium	Hard
Example From the Expected Class			
Example From a Highly Similar Class			
Eval Accuracy	1.00	0.59	0.00

Stage 1: Segment and Centroid Embeddings Generation

Stage 2: Paired Embeddings Formation and Model Training

PROJECT SUMMARY

Order fulfillment in the grocery industry usually involves a process of barcode scanning and item picking accomplished by human labors. Recent development in robotic technologies enables robots to replace human on such tasks, yet those operations, especially barcode scanning, still remain time-consuming. Such issues have lead to the exploration of vision-based systems that utilize computer vision methods to identify or verify grocery item types.

In prior works, a multi-class image classification model was trained to recognise items from images, yet it encountered notable accuracy challenges. Furthermore, when relying on a multi-class output model, the integration of new classes requires an architectural modification and re-training, substantially impacting operational efficiency. In response, we introduce an approach that harnesses segment embeddings to represent image classes, forging an agile and robust model while ensuring a consistent level of accuracy as the previous model. The new design mitigates the recurrent need for time-consuming re-training when introducing novel item types, as the embeddings of new items can serve to represent the new class without any architectural change on the model.

In summary, our design showcases significant promise for enhancing accuracy and operational efficiency of item inspection in order fulfillment processes for the grocery industry's evolving demands.

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TECHNOLOGY

Computer Science
UNIVERSITY OF TORONTO

Master of Science in
Applied Computing