# Exploring the Effects of Supervised Contrastive Learning on Alzheimer's Disease Classification With the F-18 AV45 PET Modality

Jung, Edward (School: University High School)

Despite being one of the most common diseases in the world, Alzheimer’s disease is misdiagnosed at a high rate of 12% to 23% [1]. Current state-of-the-art machine learning models for Alzheimer’s disease classification typically use Supervised Cross-entropy loss. In this project, a novel implementation of Supervised Contrastive loss was developed and tested for performance on the classification of Alzheimer’s disease. Initial hyperparameter tuning was run on a standard Convolutional Neural Network (CNN) architecture using Cross-entropy loss, finding the optimal baseline parameters for the Supervised Cross-entropy model (SupCross). Secondary hyperparameter tuning was run on a Siamese CNN architecture using Supervised Contrastive loss, finding the optimal baseline parameters for the Supervised Contrastive model (SupCon). Seed testing was then run on both models and the best models were analyzed using Area Under Curve (AUC) on Receiver Operator Curves (ROC). The results support the hypothesis that SupCon models outperform SupCross models in performance and robustness for the classification task of Alzheimer’s disease using the F-18 AV45 modality. The optimal SupCon model achieved accuracies of 92% with an ROC AUC of 0.878, a 7% improvement over SupCross. The importance of this research is that it is the first paper to describe the potential for SupCon models to be used for classification in the setting of diagnostic medicine. With implications for a new state-of-the-art model for diagnostic medicine, the SupCon model can detect faint biomarkers existent in data undetectable by humans or other SupCross models.

**Awards Won:**
Third Award of $1,000
Third Award of $1,000