Improved Domain Generalization via Disentangled Multi-task Learning in Unsupervised Anomalous Sound Detection

Satvik Venkatesh, **Gordon Wichern**, Aswin Subramanian, Jonathan Le Roux

2022 DCASE Workshop – Nancy, France

November 4, 2022

DCASE Challenge 2022 Task 2

- Task title: Unsupervised Anomalous Sound Detection for Machine Condition Monitoring Applying Domain Generalization Techniques

- Train only on normal operation data (Unsupervised)

- Domain generalization:
  - Machine's physical parameters
  - Environmental conditions
  - Maintenance
  - Recording method

- Motivation: AI-based factory automation

- Our system ranked 5th out of 32 teams in the challenge

Baseline Approaches for Unsupervised Anomalous Sound Detection
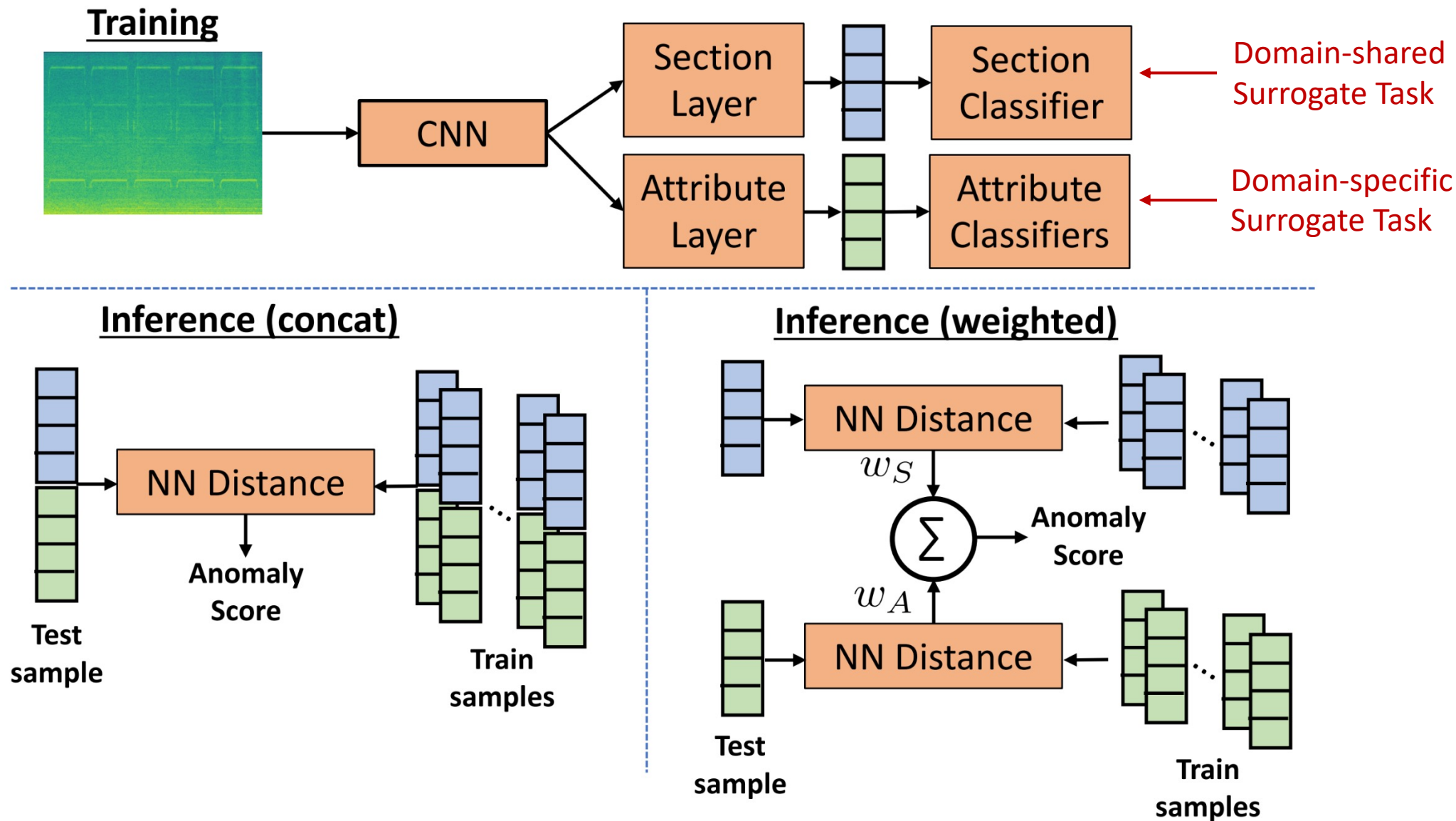
- Autoencoder
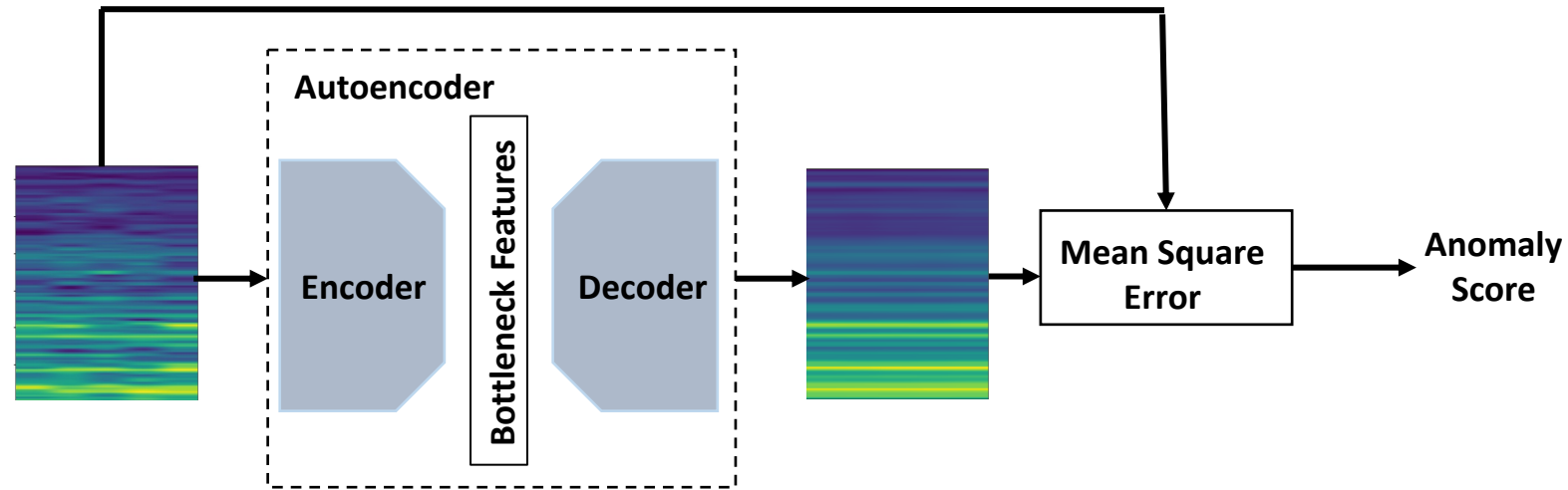
- Surrogate task classifier
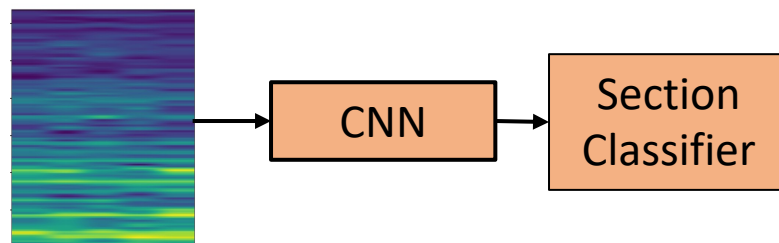
Post-processing by using confidence scores [Dohi et al., 2021] or Nearest Neighbor [Morita et al., 2021]

Disentangled Anomaly Detector

© MERL

Benefits of Disentangled Embeddings

- Outperform "entangled" multi-task learning

- We can weight embedding dimensions for computing anomaly scores
  - Functions like a single system ensemble

- Explainability – embedding elements with high anomaly scores may indicate cause
  - Example: the embeddings trained to predict operating speed are far from normal training examples, so the operating speed is likely cause of anomaly
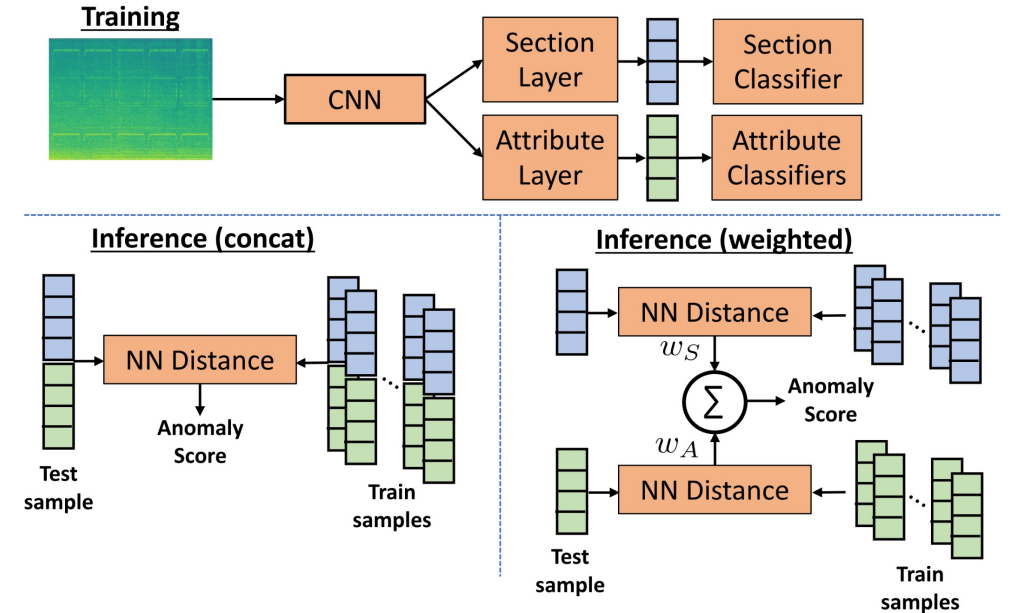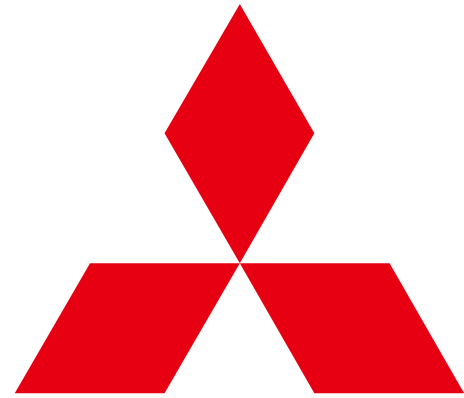
MITSUBISHI ELECTRIC
Changes for the Better