

M.Eng Project Opportunity: Domain Shift Aware Deep Learning for Condition Monitoring

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Lab: CMORE/DORL

Expected Duration: 6 months

Project Overview

Are you interested in AI for real-world industrial applications? Join us to develop a deep learning framework for **domain shift-aware condition monitoring and defect detection**. This project is a first step towards building reliable and trustworthy AI for industry, where models can **automatically detect when their environment or data distribution has changed** (domain shift) and trigger alarms or adaptation processes to maintain trustworthy predictions.

Why does this matter?

In industrial settings, machine learning models can degrade in performance when faced with new, unseen data distributions. This project aims to build models that can sense these changes in real time, making industrial AI systems safer and more reliable.

What You Will Learn

- Hands-on experience with deep learning and condition monitoring in a real industrial context
- Working with real and synthetic dataset
- Signal Processing and data cleaning.
- Advanced techniques for domain shift detection and online domain discovery
- How to process and clean industrial datasets
- Benchmarking and validation of machine learning models
- The academic publication process: from writing to peer review

Expected Tasks

- Data cleaning and preprocessing
- Training baseline deep learning models using PyTorch
- Benchmarking existing domain shift detection techniques

- Developing and evaluating novel domain shift detection methods
- Experimental validation and results analysis
- Assisting in writing technical reports or research papers

Who Should Apply?

- Strong programming skills in Python (experience with PyTorch is an asset)
- Background in Mechanical Engineering, Electrical & Computer Engineering, or related fields preferred
- Knowledge of FFT is an asset
- Interest in AI, machine learning, and their industrial applications
- Good written communication skills
- Interest in participating in the paper publication process

Related Resources

Papers:

- Detecting Concept Drift in Neural Networks Using Chi-squared Goodness of Fit Testing." *arXiv preprint arXiv:2505.04318* (2025).
- *Sensors selection for tool failure detection during machining processes: A simple accurate classification model* CIRP Journal of Manufacturing Science and Technology (2021)

Datasets:

- Tony Schmitz (2025), [Digital Machining Database](#)
- Agogino, A., & Goebel, K. (2007). BEST Lab, UC Berkeley. "Milling Data Set", NASA Prognostics Data Repository [NASA Ames Prognostics Data Repository](#)