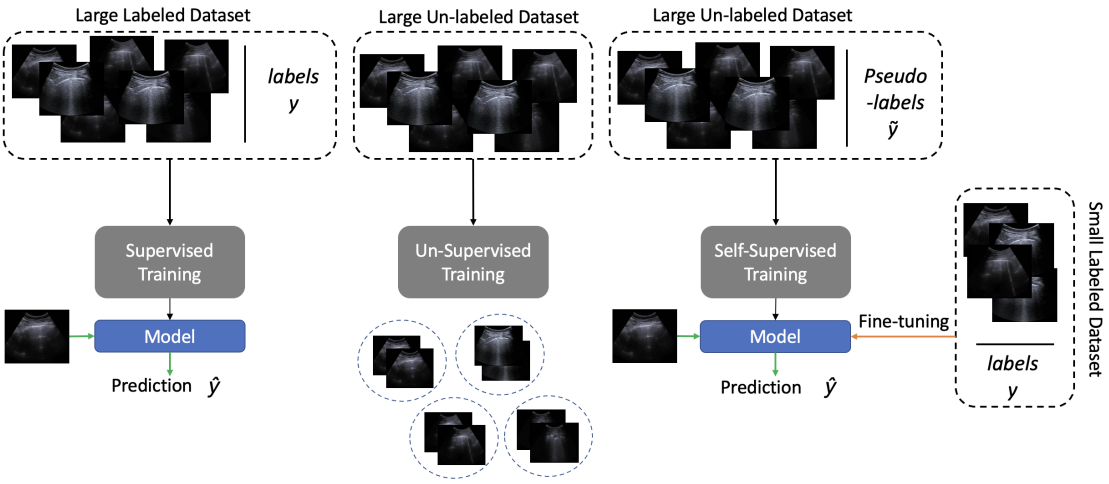
Addressing Label Scarcity in Lung Ultrasound (LUS) Frame-level Classification through Unsupervised and Self-Supervised Techniques



Since the outbreak of COVID-19, lung ultrasound (LUS) has emerged as a promising tool to assess the severity of lung alteration. This assessment is based on the evaluation of LUS patterns. These patterns include hyper-echoic horizontal and vertical artifacts and hypo-echoic small to large consolidations. To assist clinicians in the evaluation process, various DL-based methods have been developed [1]. Although LUS imaging resulted in the generation of a large amount of critical data for diagnosis, treatment planning, and disease monitoring. However, obtaining high-quality labels is a challenge when it comes to medical imaging data. In particular, for LUS, it is further compounded by the inter-operator variability due to the subjective nature of analysis. This resulted in the limited availability of annotated data, limiting the performance and generalization of supervised deep learning models. To this extent, this project aims to address these challenges by making use of unsupervised and self-supervised techniques for accurate classification of LUS patterns.

[1] Khan et al., "Benchmark methodological approach for the application of artificial intelligence to lung ultrasound data from covid-19 patients: From frame to prognostic-level", Ultrasonics 2023.

Goals & Tasks

- Review of state-of-the-art on automated approaches for LUS frame-level classification.
- Evaluating unsupervised and self-supervised techniques and comparing with the existing methods [1].

Qualifications

- Interest in medical imaging analysis and ML/DL techniques.
- Experience with the Python based deep learning framework PyTorch.
- Registered to one of the following:

  ☐ **Bachelor Thesis**

  ✓ **Seminar Project**

  ✓ **Master Thesis**

Contact

Umair Khan: ukhan@tugraz.at

Institute of Machine Learning and Neural Computation
Graz University of Technology
Inffeldgasse 16b/I, 8010 Graz