



Multimodal Learning for Surgical Outcome Prediction

1 General Info

Project Title: Multimodal Learning for Surgical Outcome Prediction

Supervisors: Azade Farshad, Yousef Yeganeh

Contact Email: azade.farshad@tum.de, y.yeganeh@tum.de

2 Background and Motivation

Surgical outcome prediction is a critical challenge in modern healthcare that directly impacts patient care, resource allocation, and clinical decision-making. Traditional prediction methods often rely on limited clinical variables and physician experience, which may not capture the full complexity of surgical cases. The recent availability of comprehensive multimodal data, including pre-operative information, intraoperative measurements, laboratory results, and device data, offers unprecedented opportunities to develop more accurate prediction models through advanced analytics.

3 Project Outline

This project leverages the INSPIRE multimodal surgical dataset [2] to develop comprehensive surgical outcome prediction models. Our objectives include:

- Mortality Risk Prediction
 - Development of models to predict post-operative mortality risk
 - Identification of key predictive factors across different data modalities
- ICU Length of Stay Estimation
- Post-operative Trajectory Modeling
 - Prediction of vital sign trajectories
 - Forecasting of laboratory value trends
 - Early identification of potential complications

The project employs advanced machine learning techniques for multimodal data fusion [1] and aims to develop interpretable models that can effectively support clinical decision-making.



4 Technical Prerequisites

- Good background in machine learning and deep learning
- Experienced in PyTorch
- Experienced in Python

5 Benefits

- Weekly supervision and discussions
- Possible novelty of the research
- The results of this work are intended to be published in a conference or journal

6 Work packages and Time-plan

	Description
WP1	Familiarizing with the literature.
WP2	Implementing the baselines
WP3	Improving the baselines and validation on relevant datasets
WP4	Implementing the model
WP5	Finalizing the results and evaluation

Table 1: Suggested Work Packages

References

- [1] Sayna Ebrahimi, Sercan O Arik, Yihe Dong, and Tomas Pfister. Lanistr: Multimodal learning from structured and unstructured data. *arXiv preprint arXiv:2305.16556*, 2023.
- [2] Leerang Lim, Hyeonhoon Lee, Chul-Woo Jung, Dayeon Sim, Xavier Borrat, Tom J Pollard, Leo A Celi, Roger G Mark, Simon T Vistisen, and Hyung-Chul Lee. Inspire, a publicly available research dataset for perioperative medicine. *Scientific Data*, 11(1):655, 2024.