

Group 4 - Project Proposal

1. What problem did you select and why did you select it?

We chose to investigate the digitalization of analog ECG images due to its potential to improve cardiovascular care for millions worldwide. An electrocardiogram (ECG) is a crucial diagnostic tool that records the heart's electrical activity to detect various cardiac conditions. Digitizing historical ECG data enables trend analysis over time and allows clinicians to provide older patients with continuity in records analog and digital records.

Beyond simple data preservation, digital ECG conversion opens the door to several impactful use cases. Machine learning models can analyze large volumes of ECG data to detect early signs of conditions such as arrhythmias, myocardial infarction, or heart failure risk.

2. What database/dataset will you use? Is it large enough to train a deep network?

ECG image digitalization using Deep Learning:

<https://www.kaggle.com/code/taylorsamarel/v3-physionet-ecg-image-digitization/input>

3. What deep network will you use? Will it be a standard form of the network, or will you have to customize it? Deep network choice

We are thinking about using a multi-task convolutional encoder with lightweight task-specific heads, rather than one monolithic end-to-end model. This balances accuracy, speed, and debuggability for the ECG-image

4. What framework will you use to implement the network? Why?

Pytorch or Tensorflow, due to its flexibility for custom losses and multi-task heads, large vision ecosystem, and smooth deployment via ONNX/TensorRT; classical CV (OpenCV) and external OCR complete the pipeline.

5. What reference materials will you use to obtain sufficient background on applying the chosen network to the specific problem that you selected?

Academic and Technical Papers

- U-Net: Convolutional Networks for Biomedical Image Segmentation (Ronneberger et al., 2015) — foundational for the segmentation head used to extract ECG traces from images.
- YOLOv8 / YOLOv5 Object Detection Frameworks (Ultralytics, 2023) — reference for the detection head used to localize ECG panels
Framework Documentation and Tutorials
- PyTorch official documentation and PyTorch Lightning guides
OpenCV and scikit-image documentation

6. How will you judge the performance of the network? What metrics will you use?
Segmentation and Detection Metrics, Precision, Recall, and F1-score, used for the detection head to assess localization of lead panels and calibration boxes.
7. Provide a rough schedule for completing the project.
Week 1,2 - Preprocessing the data
Week 3 - Model Building
Week 4 - App building and Report making