Introduction
Misplaced ECG leads are estimated to be the cause of as much as 4% of misleading results\textsuperscript{1} given to patients, occasionally causing fatalities\textsuperscript{2}. This project seeks to replace current leads with a pad of ECG electrodes, then use machine learning algorithms to select the optimal signal; additionally running diagnoses on acquired data.

Hardware Interface
The system has 16 individual 24-bit ADC channels feeding 2 Audino Due units, which handle buffering. These units in turn feed an embedded computer which uploads to our central server.

Feature Extraction
In order to use machine learning algorithms, certain characteristics (features) are extracted from a windowed set of data. These include:
- Selective wavelet transformation
- Length of time of standard cardiac segments
- Weight, age, and gender
- Discrete Fourier Transform (DFT) results

Implementation
Storage is implemented using a MySQL database on a central server. We then have two separate server processes which handle Feature Extraction and Analysis methods respectively. This is designed to allow for highly scalable systems.

Analysis Methods
Diffusion maps describe the similarity between data points by embedding data from a higher dimensional space onto a lower one. Diffusion maps use the eigen-decomposition of a Markov probability matrix which is created a distance metric based on the feature set\textsuperscript{3}.

References