Data Menders Design Review

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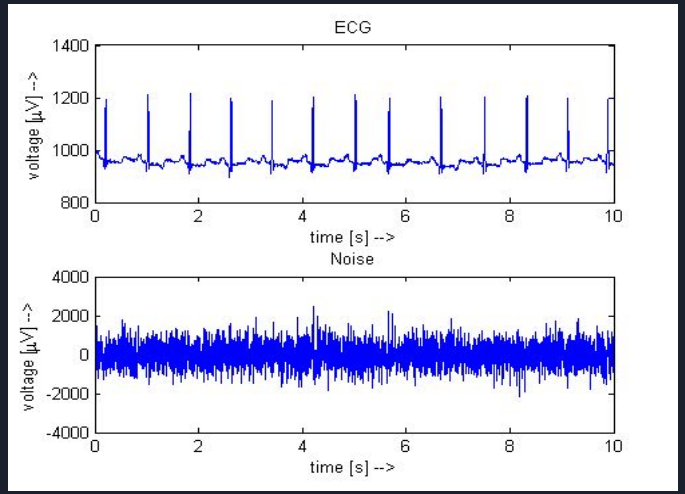
Problem Statement

https://www.cefns.nau.edu/~edo/Classes/CS_Capstone/Projects/F17/Afghah-FalseAlarmICU-F17.pdf

- Automated monitoring has revolutionized care in modern ICU units.
- 80-99% of alarms triggered are false or meaningless.
- Emergency Care Research Institute (ECRI) placed false alarms at number one in the list, “Top 10 Health Technology Hazards” for the years 2012, 2013 and 2015.
- The FDA database received 566 reports of patient deaths related to alarms of monitoring devices.
- False alarms can also result in depressed immune systems of patients.

Problem Statement Continued

- Most efforts to reduce false alarm rate are focused on improving hardware.
- Humans are imperfect so as long as this hardware is connected to humans, we will receive imperfect readings.



http://bio.felk.cvut.cz/biocmsms/uploads/images/ICA_images/signal_noise.png

Solution

Our solution is to make a software app that can take signals from multiple devices and analyze the data from the devices. Once that data is analyzed, it can be determined if an alarm should go off or not. There are three possible parts to our solution, Global, Local, and prediction. The two parts that we are doing are local and Global, and we are looking into doing prediction.

- Global

Global refers to data from that available data set. Meaning the data set that is used, is used as the average by other devices.

- Local

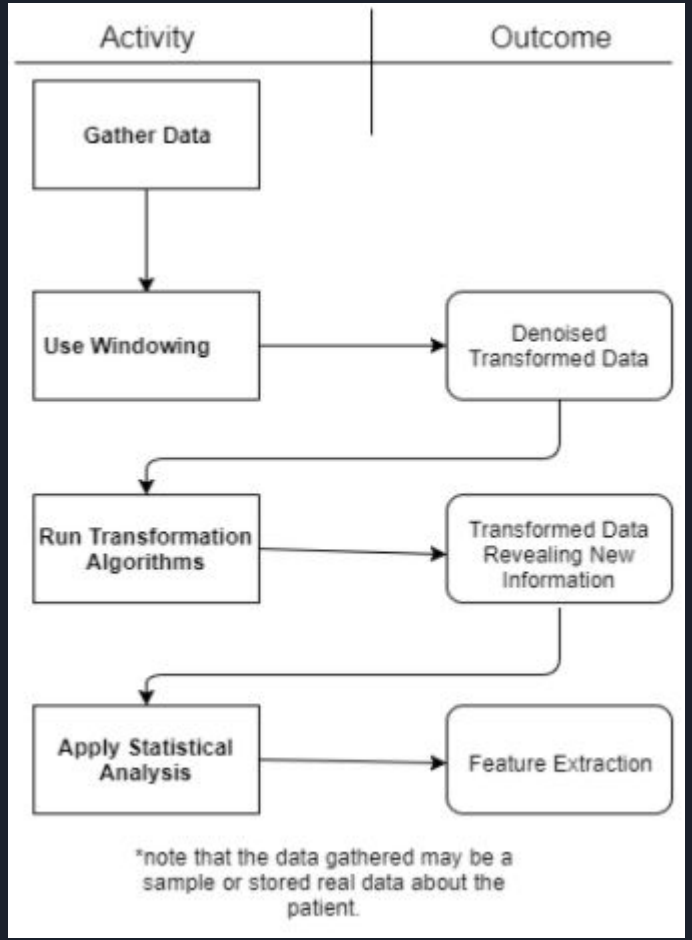
Local data is the patient's data that is being collected over the stay of their visit. So after time has passed, we will start comparing the incoming data to the collected data from the patient. This gives more accurate results in for alarm detection.

- Prediction

Prediction is being able to predict if something bad is about to happen. This means that the software is picking up signs that you are about to have a problem, and an alarm goes off then, instead of later.

Key Requirements

- Back End
  - Signal Input
  - Feature Extraction and classification
  - Alarm determination
- Front End/User Interface
  - Real time signals
  - Alarm status and classification
  - Parameter tweaks
- Extras
  - User Manual



Functional and Performance Requirements

- Data management
  - Many input signals
  - Various, concurrent signal processing techniques
  - Data mining on patient data
- Reliability
  - Downtime is unacceptable
- Accuracy
  - User determined parameter tweaks for personalized alarm classification

Risks and Feasibility

- Inaccuracies
  - False positives -> Safe but means our product isn't working as intended.
    - Somewhat likely but not life threatening
    - Cause
      - New patient so pre-existing conditions are unknown.
    - Solution
      - More data on the patient. Possibly less strict parameters.
  - False negatives -> Lives could be lost.
    - Causes
      - Algorithmic
      - Signal corruption
    - Solution
      - Design change
      - Parameter tuning.

Schedule

- Phase 1
  - Researching data transforms
  - Processing data with various transforms
  - Extract features out of raw signal and transformed data.
- Phase 2
  - Determine when to sound an alarm
  - Use patient data to make more informed decision
  - Construct a user interface

Conclusion

- In the end, the goal for our project is to develop a software that reduces false alarms in the ICU.
- This can give nurses and patients a more relaxed environment.
- Nurses can have better react times.
- This is not only helpful, but important to help people and save lives.