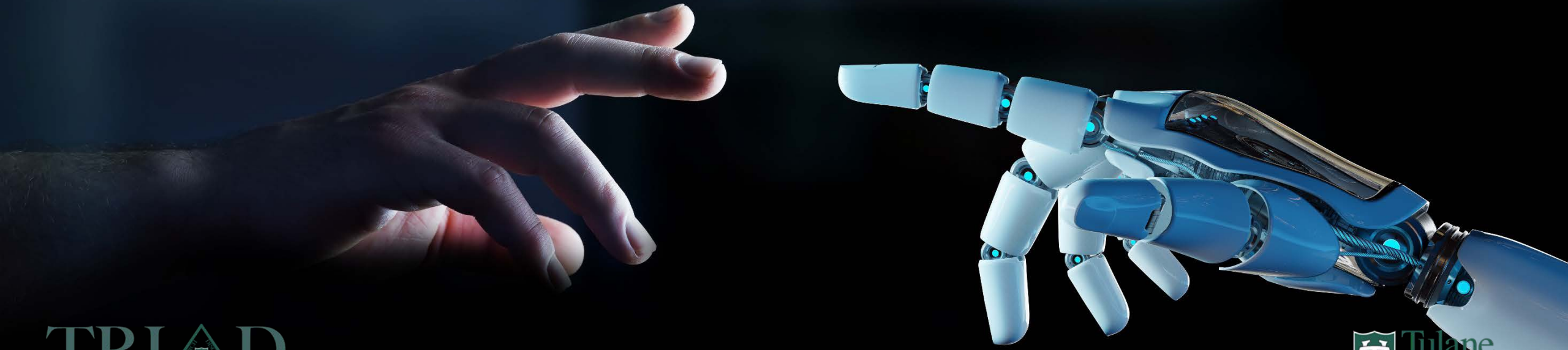


Tulane Research Innovation for Arrhythmia Discovery

Machine Learning Approaches In Digital Health

Chan Ho Lim



Predict
AF Recurrence?



88,000
Unlabeled ECG
Strips



Uhh...
Signal
Quality and labels?

CONTENTS

Part1 Data Collection



Part2 Data Cleaning



Part3 Research



Part 1

Collecting Data

00. Mobile Devices

01. Noise Generation

02. SNR Estimation

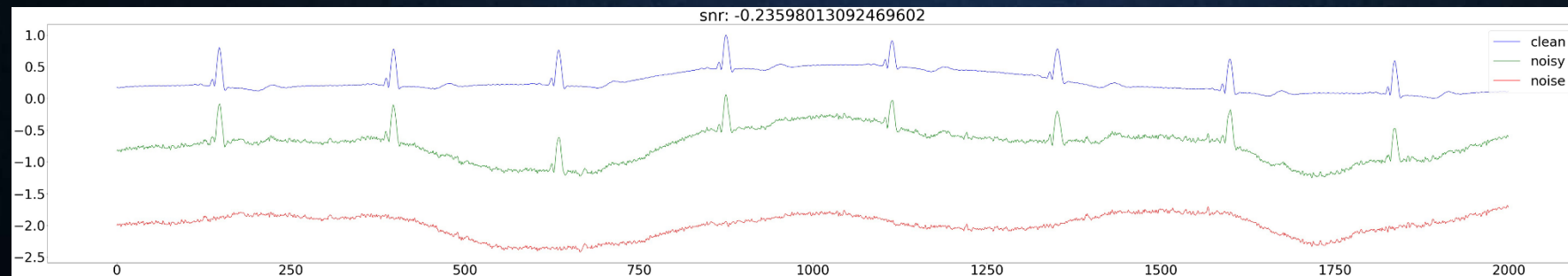
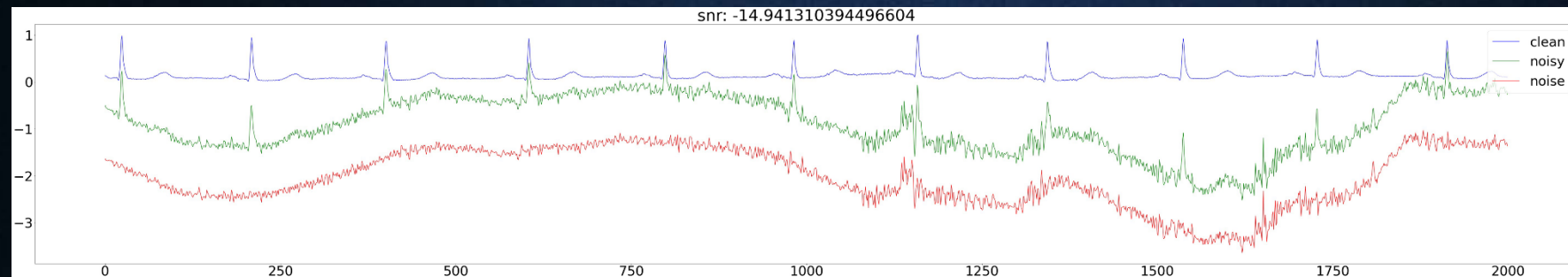
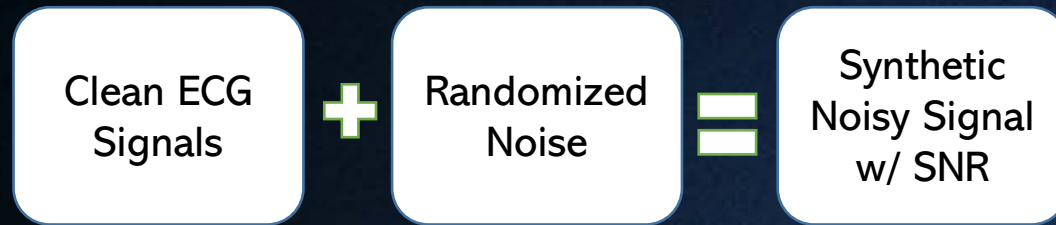
Machine learning with mobile health devices

- 00. PPG signals from smart watch.
- 01. Mobile ECG monitoring devices.
- 02. Blood Pressure Measurements.



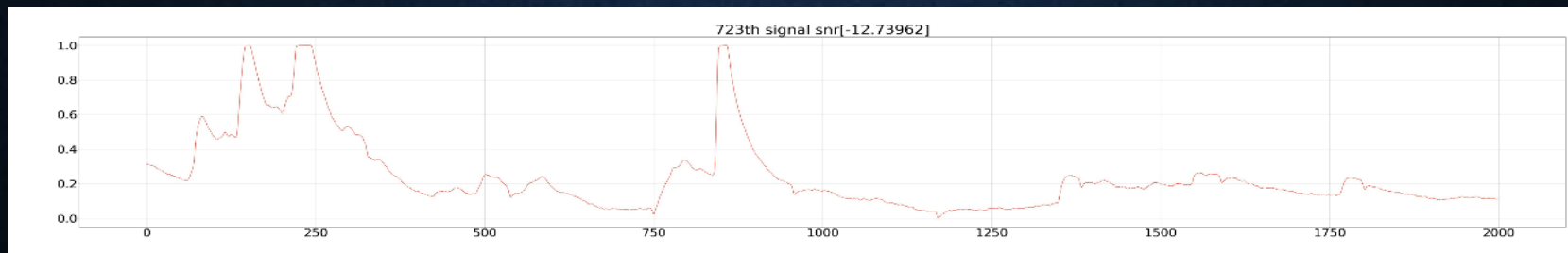
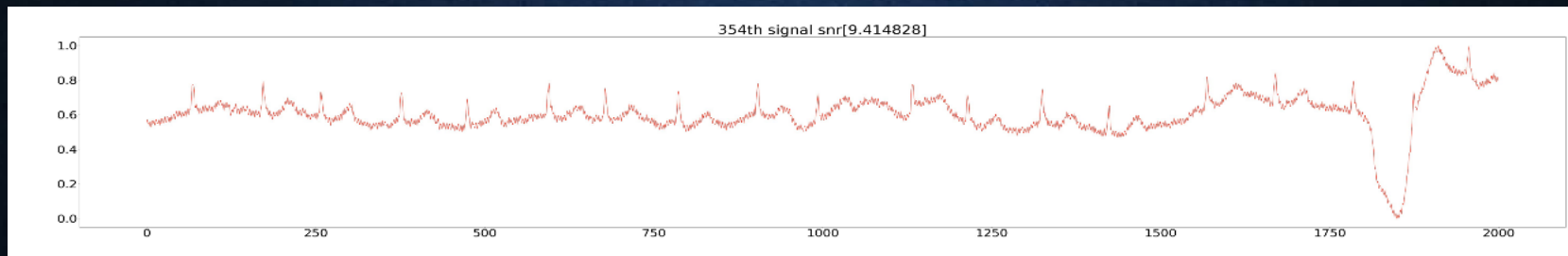
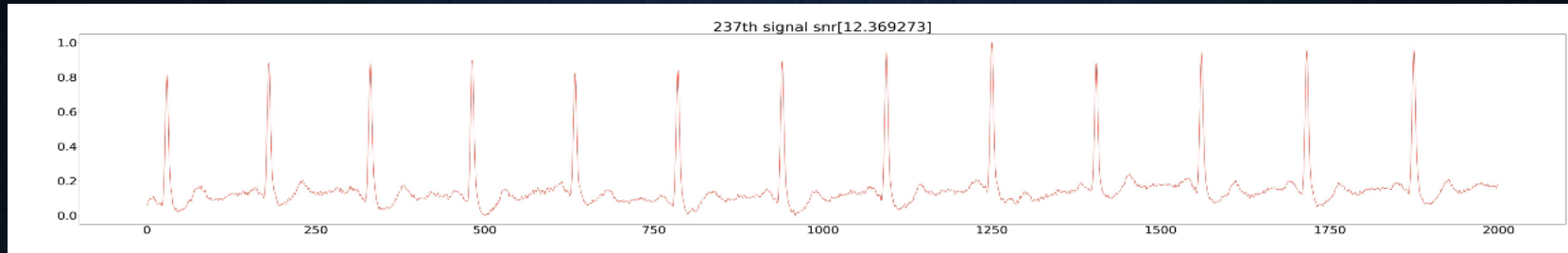
Data Quality Assessment

- ▷ Artificial Intelligence based Signal Quality Assessment
- ▷ Synthetic noisy signal generation and signal to noise ratio (SNR)



Data Quality Assessment

- ▷ Artificial Intelligence based Signal Quality Assessment
- ▷ Deep learning-based signal to noise ratio (SNR) estimation



Part 2

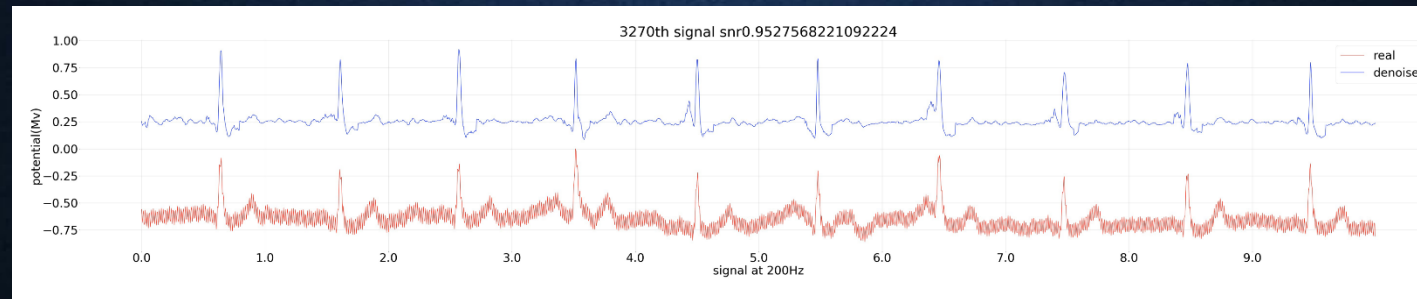
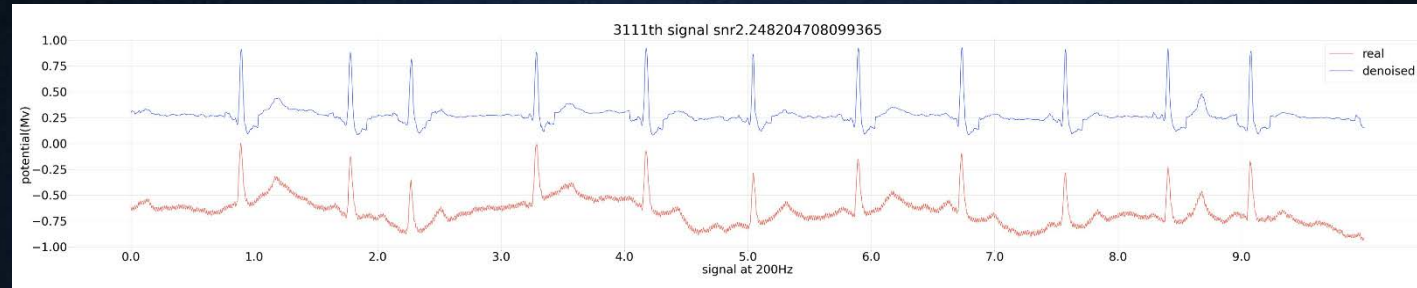
Data Cleaning

01. Tailored Denoising

02. Validation

Data Quality Enhancement

- ▷ Artificial Intelligence based Denoising
 - ▷ Tailored Signal Denoising with Machine Learning



Validation of our methods

Improvement in Noisy ECG Classification

- Comparison : Published Paper vs our results with AliveCor 1-lead ECG Data
- Method : Utilize the state-of-the-art model to classify both data



Hsieh et al, MDPI, 2019

Part 3

Triad Projects

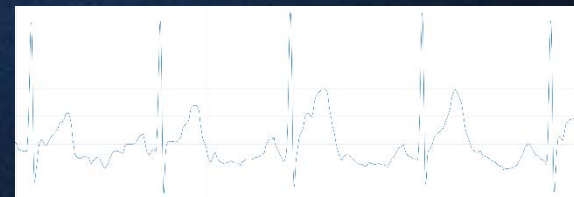
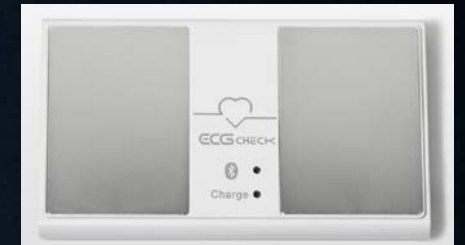
01. Universal Classifier

02. PPG Utilization

02. AF Recurrence

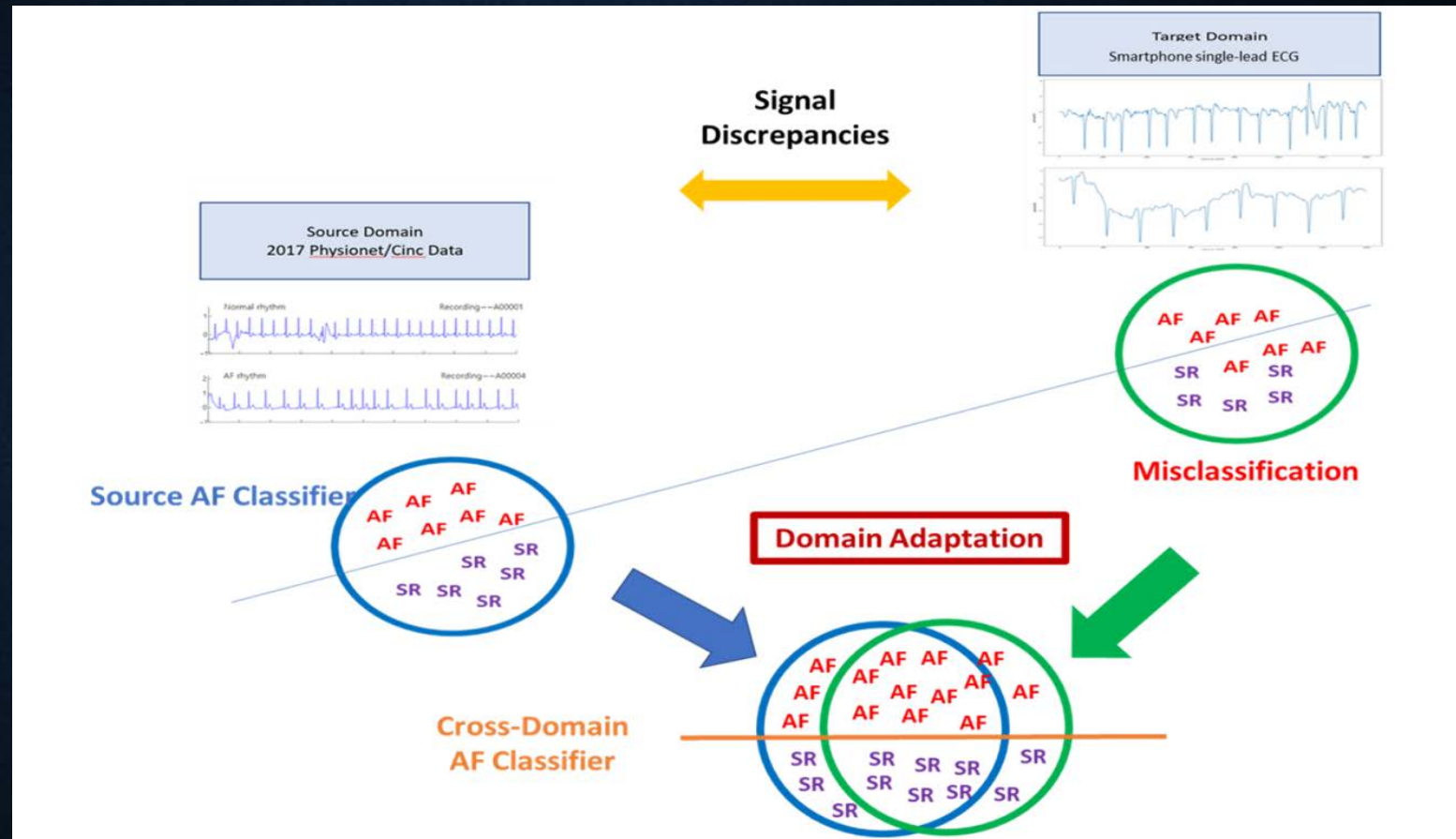
Universal AF Classifier

- ▷ Minimizing the cost of manual labeling
- ▷ Data Discrepancy



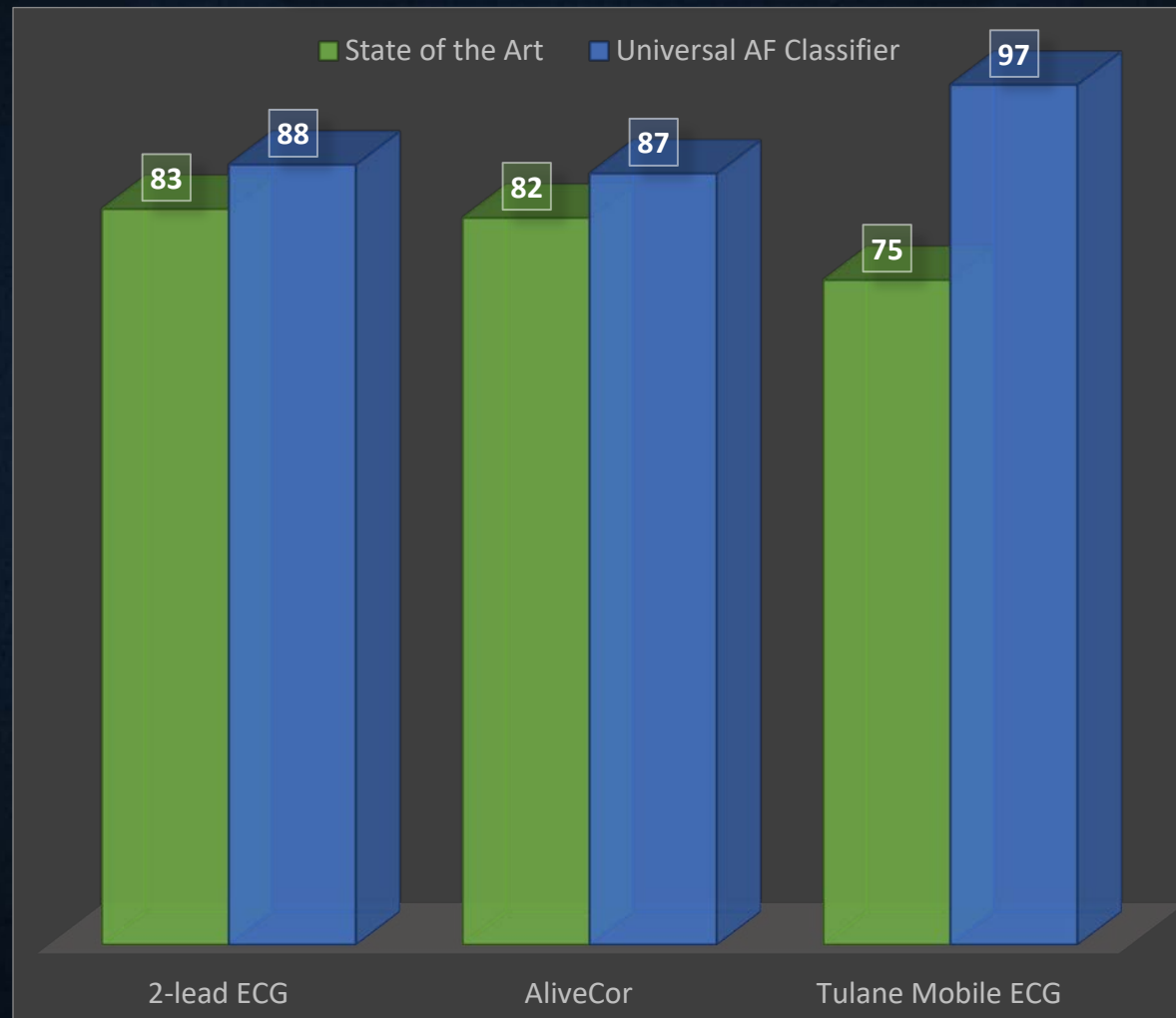
Universal AF Classifier

- ▷ Minimizing the cost of manual labeling
- ▷ Data Discrepancy
- ▷ Domain Adaptation



Universal ECG Classifier

AUC Score Comparison



Datta et al, CinC, 2017

TRIAD Projects

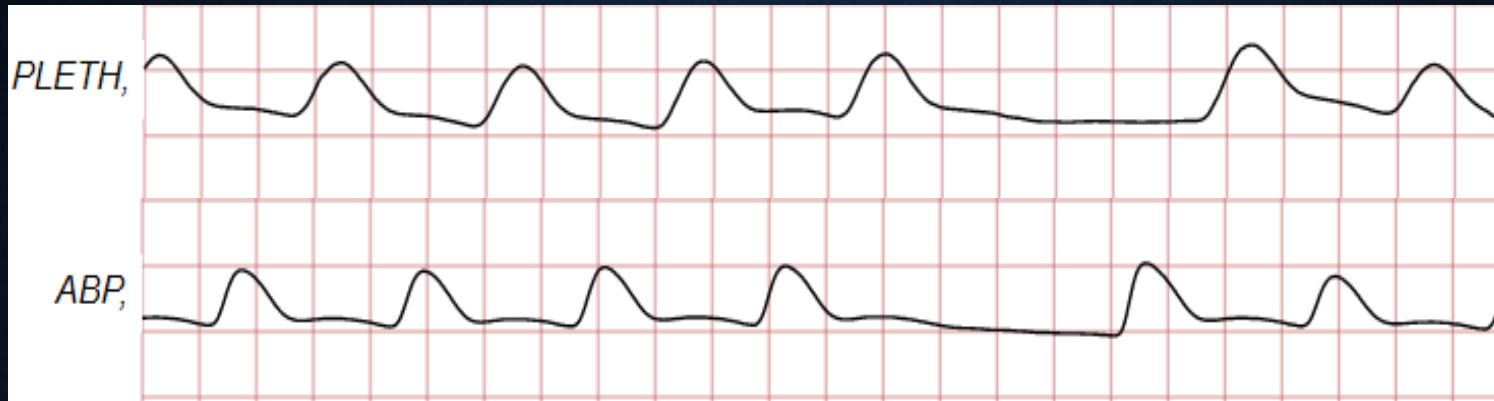
Uncovering

The Potential in Mobile Health Signals

Universal AF
Classifier

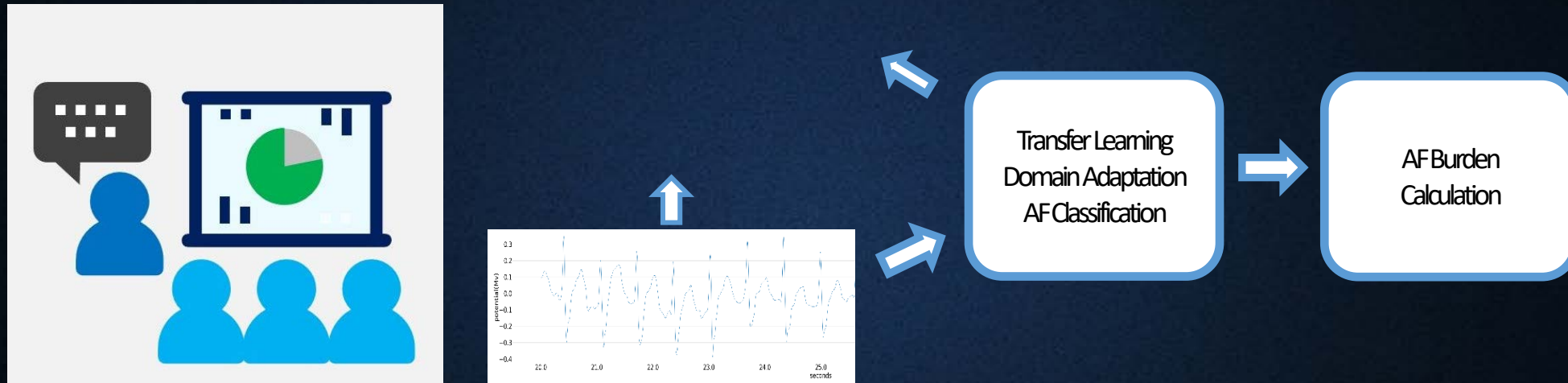
PPG Mapping

- ▷ Generating ECG and Blood Pressure from PPG Signals
- ▷ Simultaneous Measurements



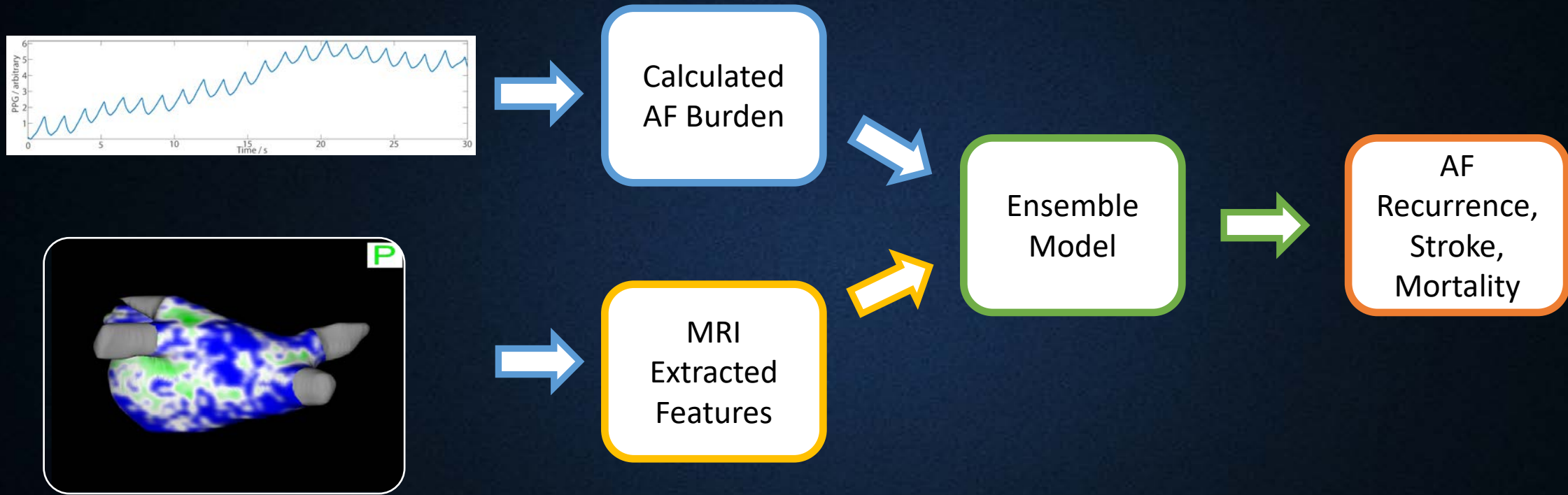
PPG AF Burden

- ▷ Calculating the AF Burden from continuous PPG signals
- ▷ Continuous PPG Classification with Transfer Learning Domain Adaptation Method

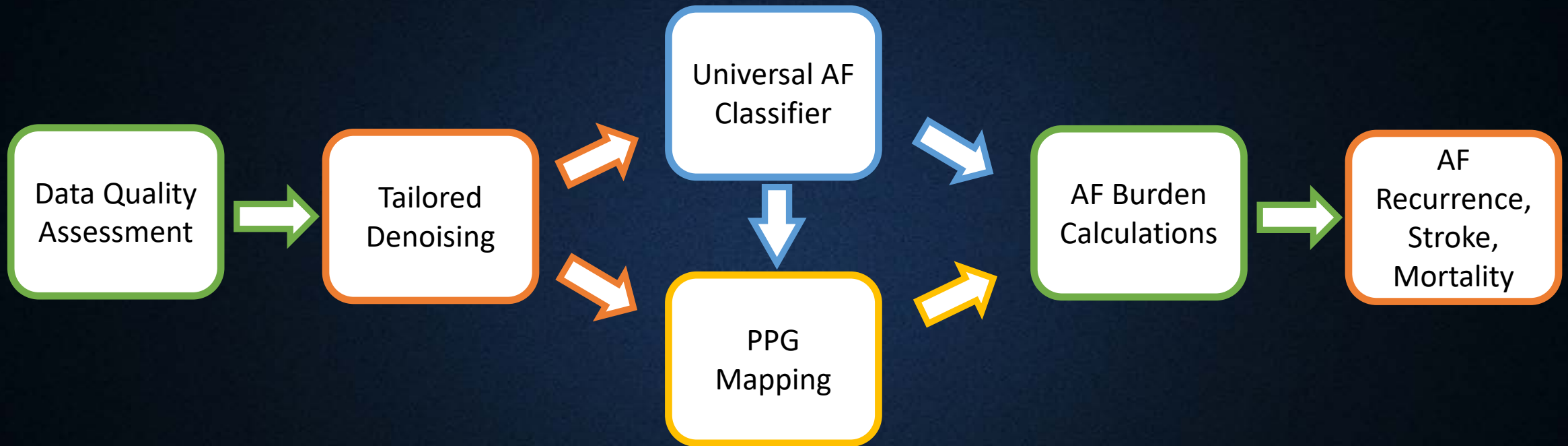


AF Recurrence Prediction

- ▷ Predicting AF Recurrence with AF Burden, and MRI images
- ▷ Ensemble model of AF Burden calculation and image data.



Overall Research Design



Bon Appétit