

Nanopore Sensors and Algorithms

SenSIP Algorithms and Devices REU

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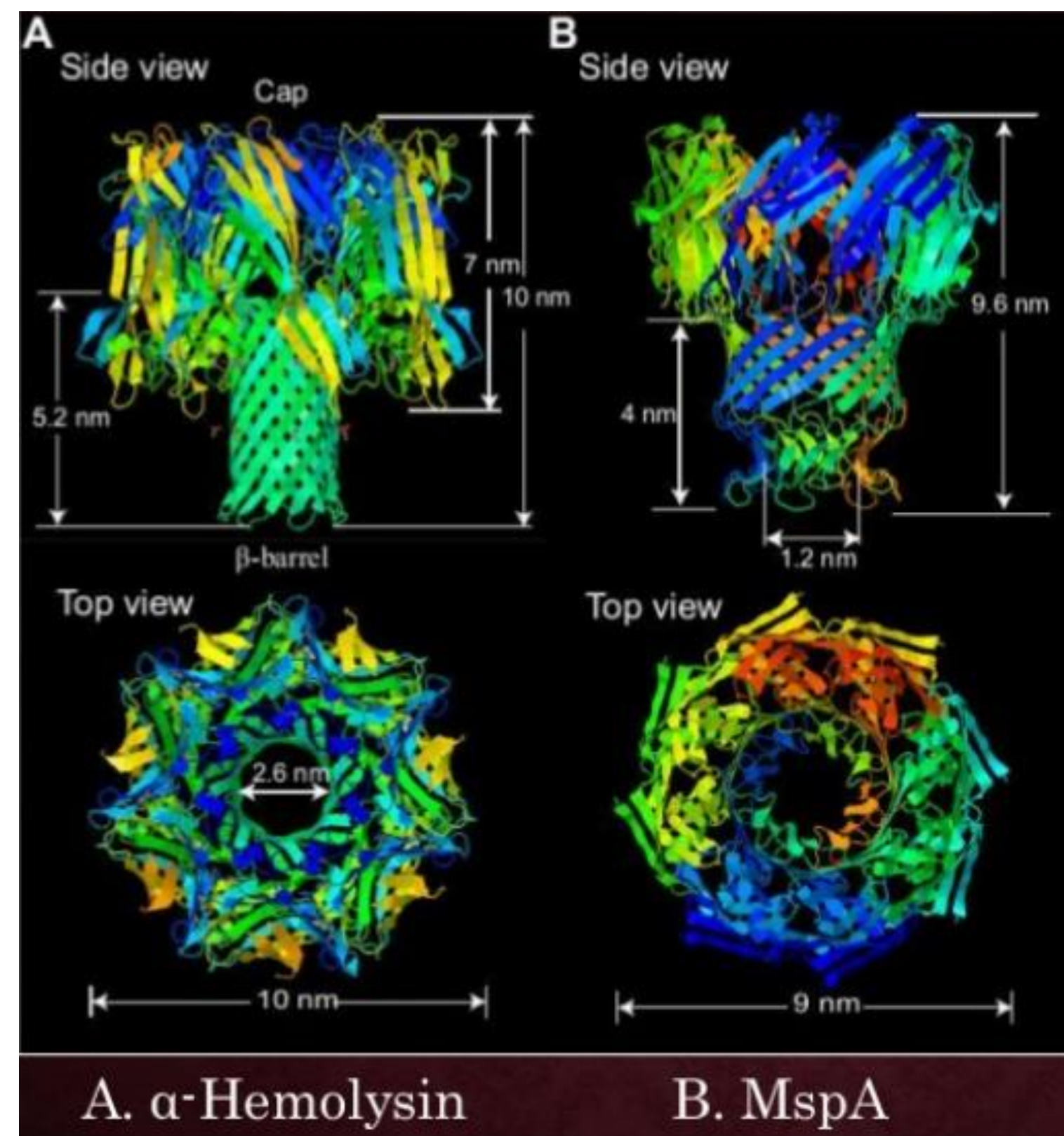


ABSTRACT

- Develop nanoscale ion channel sensor
- Implement machine learning algorithms to increase classification, specificity, and sensitivity

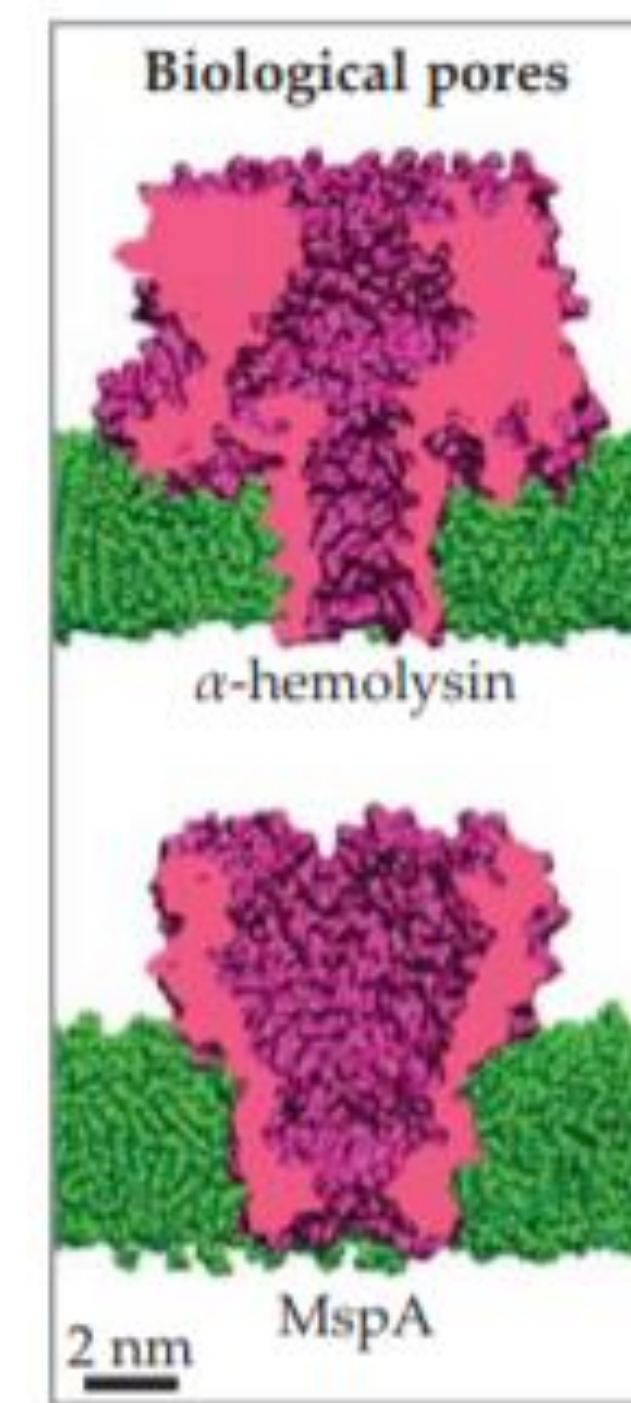
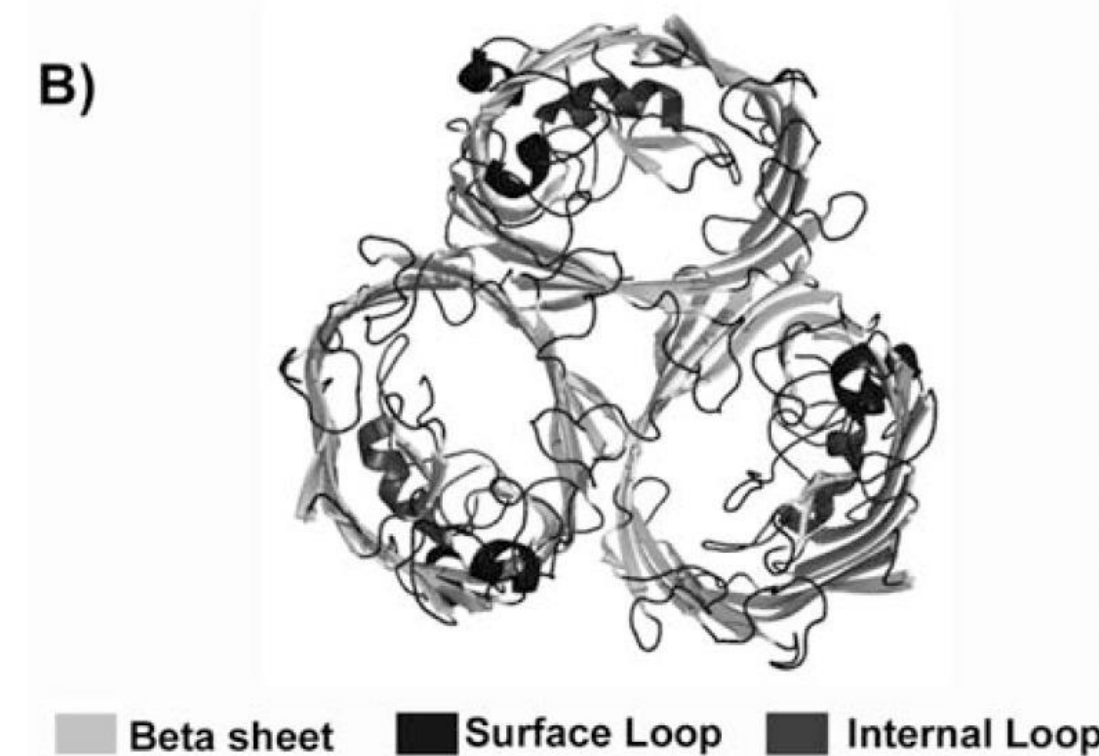
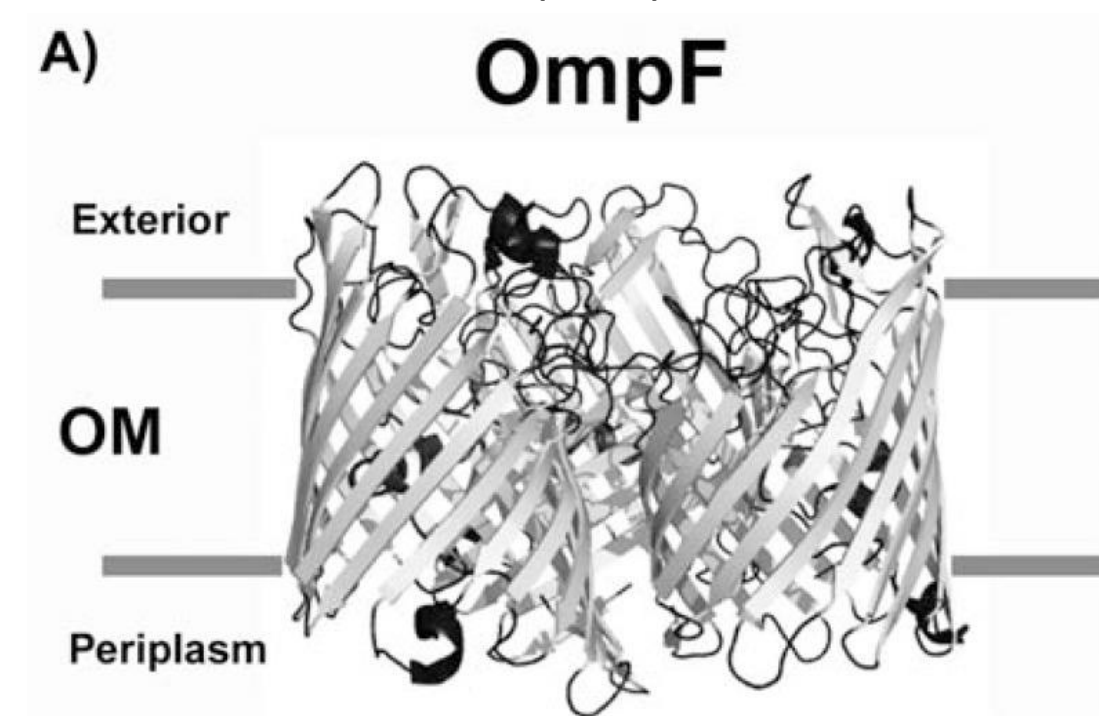
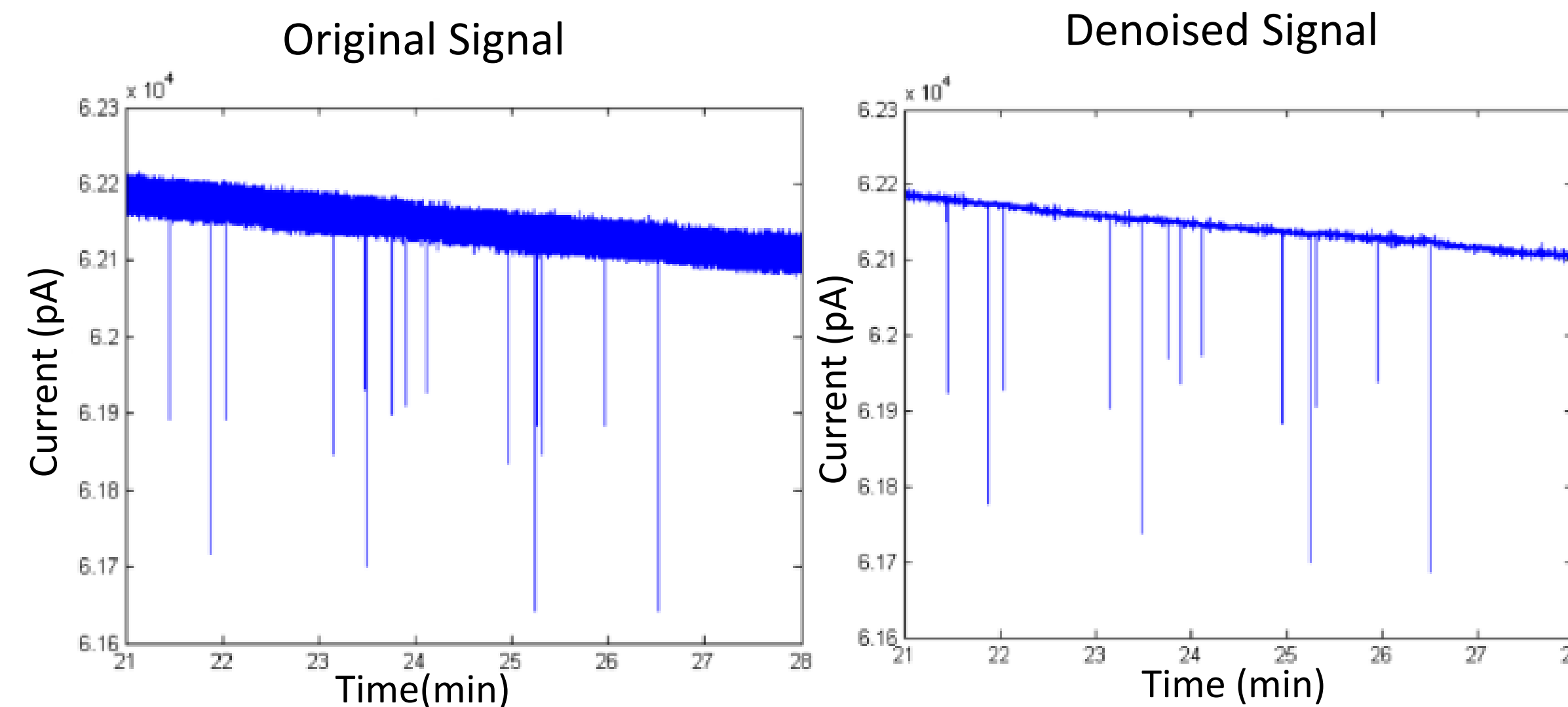
MOTIVATION

- Detect biochemical agents i.e. Anthrax
- Observe analytes at the single molecule level



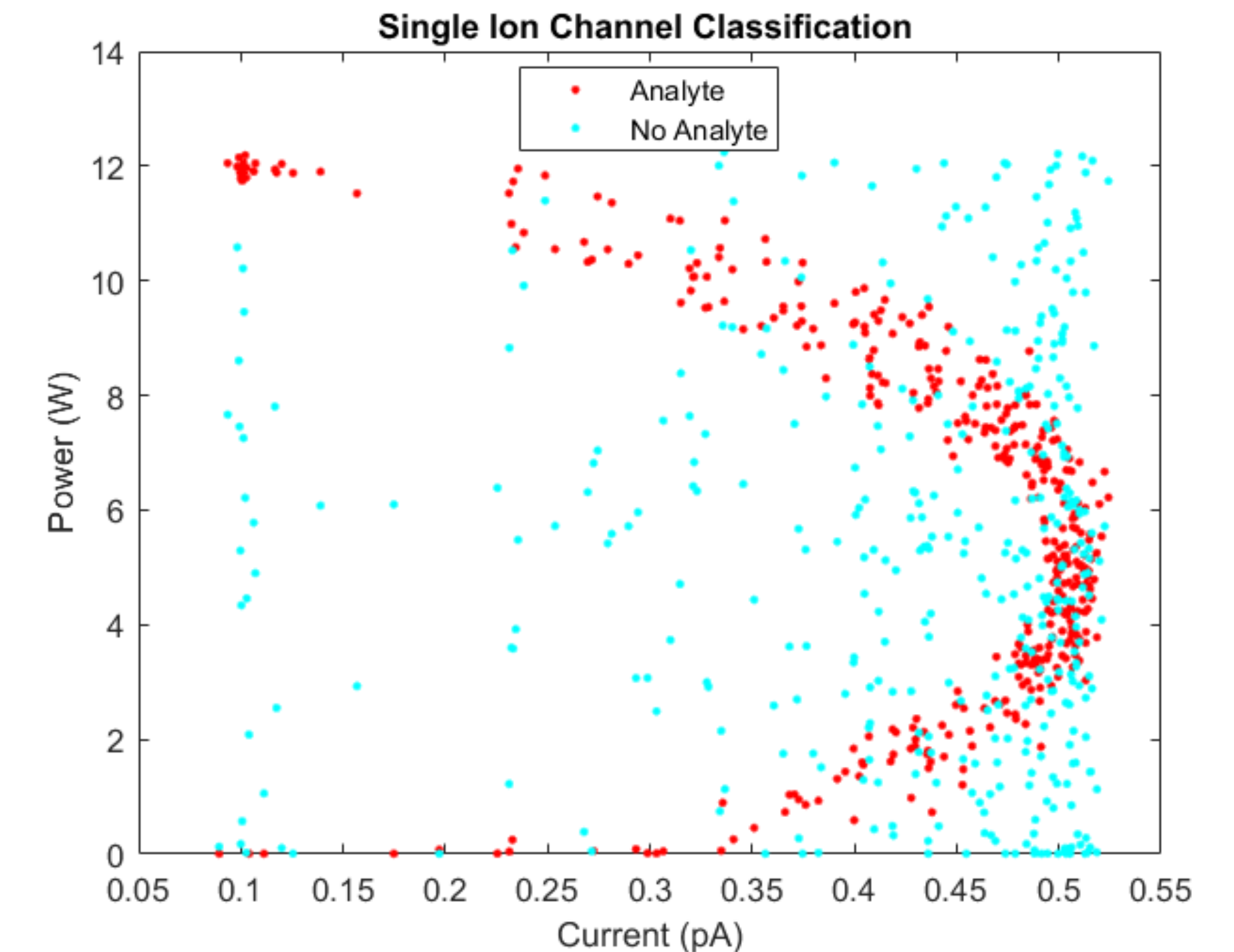
EXPERIMENTAL METHODS: SENSORS

- Generate simulated ion channel data and use Power Spectral Density (PSD) based feature extraction
- Matrix completion with low rank assumption improves classification compared to using features directly
- Transform domain feature extraction and dwell time analysis
- Wavelet decomposition and the Discrete Wavelet Transform



PRELIMINARY RESULTS

- PSD based feature extraction successfully classified simulated ion channel signals with an analyte present and signals without an analyte present



CONCLUSIONS

- Denoising with wavelets can be achieved
- Modest success with clustering, additional training required
- Experiments with other machine learning algorithms
- Testing noisy sequences required
- Ion channel array simulations are planned

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ACKNOWLEDGEMENT

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PROBLEM STATEMENT

- Difficult to distinguish between features and artifacts
- Consistently forming lipid bilayers requires lots of preparatory work
- Inserting the desired amount of ion channels into the bilayer reliably is a challenge

