

Health Monitoring Using Digital Stethoscopes and Machine Learning

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SenSIP Algorithms and Devices REU

PROBLEM STATEMENT

- Estimate the pulse rate from electronic stethoscope sensors;
- Assess respiratory problems;
- Use machine learning to cluster healthy and pathological data;

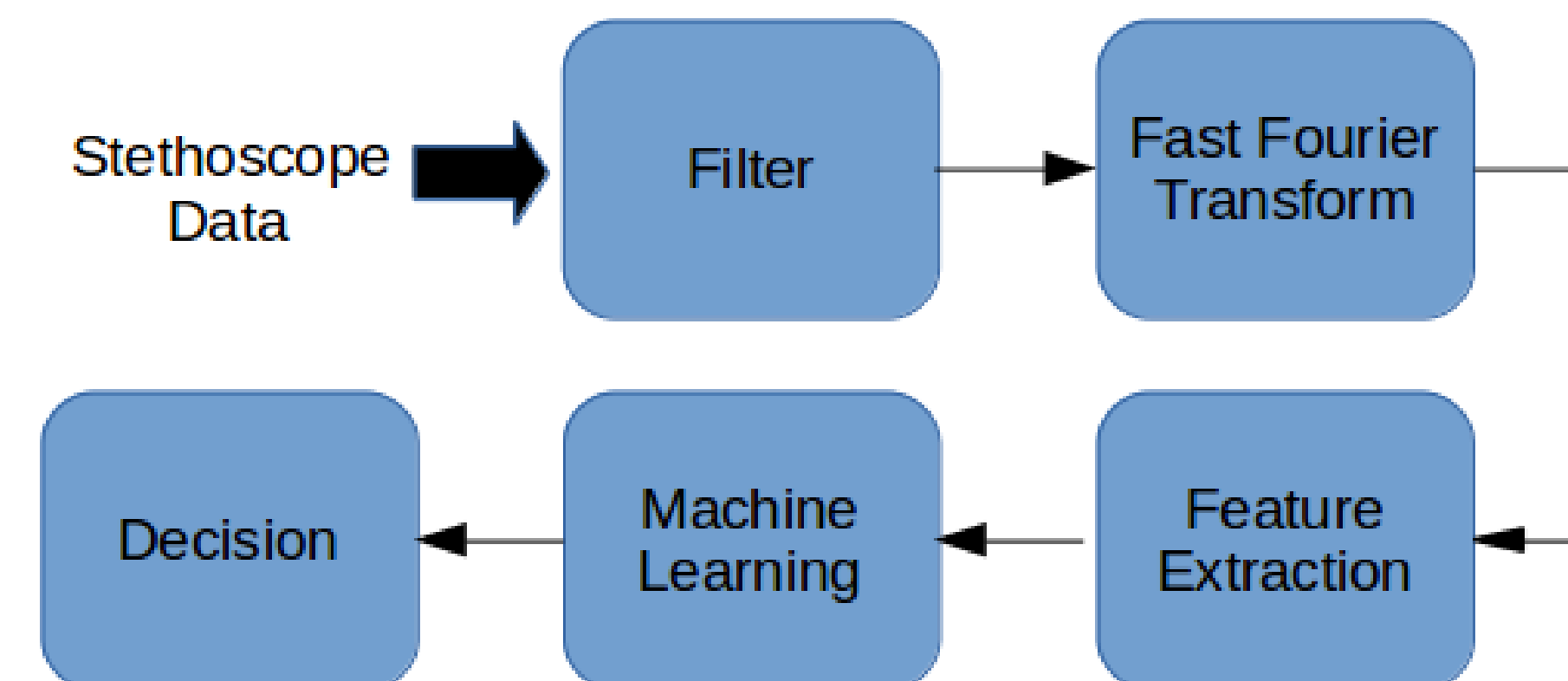
SENSOR: DIGITAL STETHOSCOPE

- Based on acoustic signatures
- Some use sensor arrays
- Wireless connectivity to PCs and smartphones



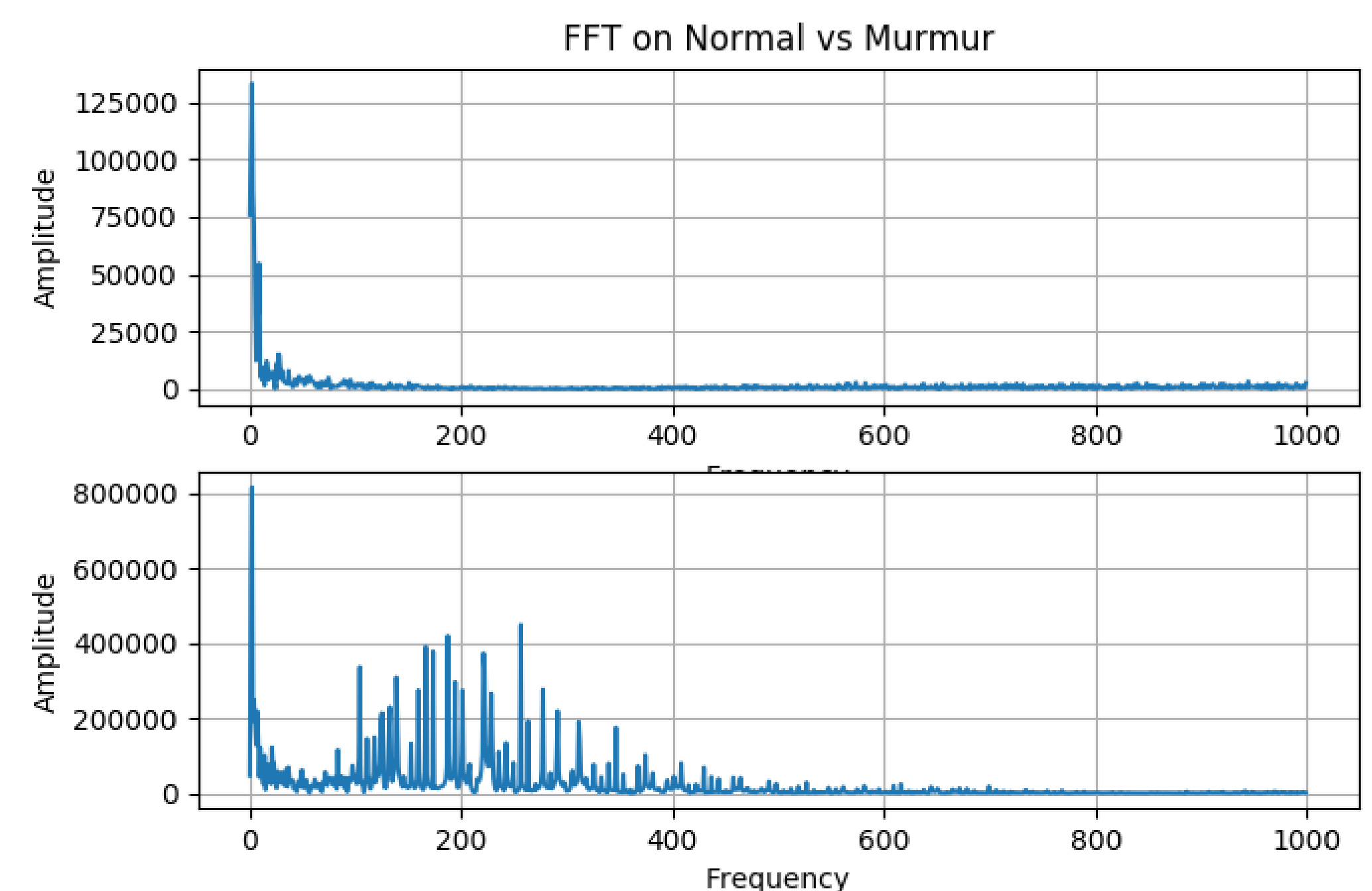
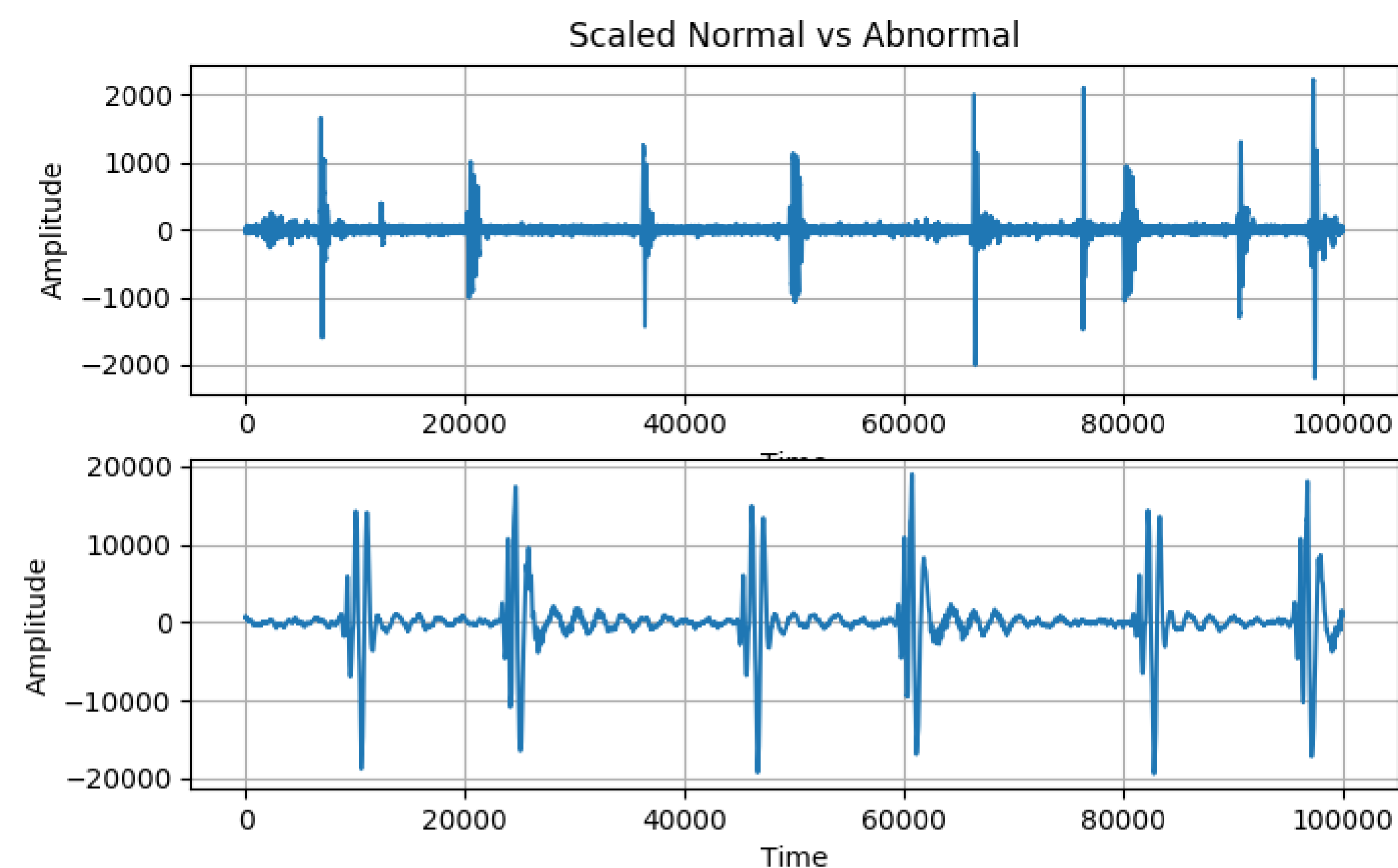
FILTERING AND MACHINE LEARNING

- Test different filtering methods including adaptive filtering to remove noise
- Compare different machine learning methods
- Use Python code

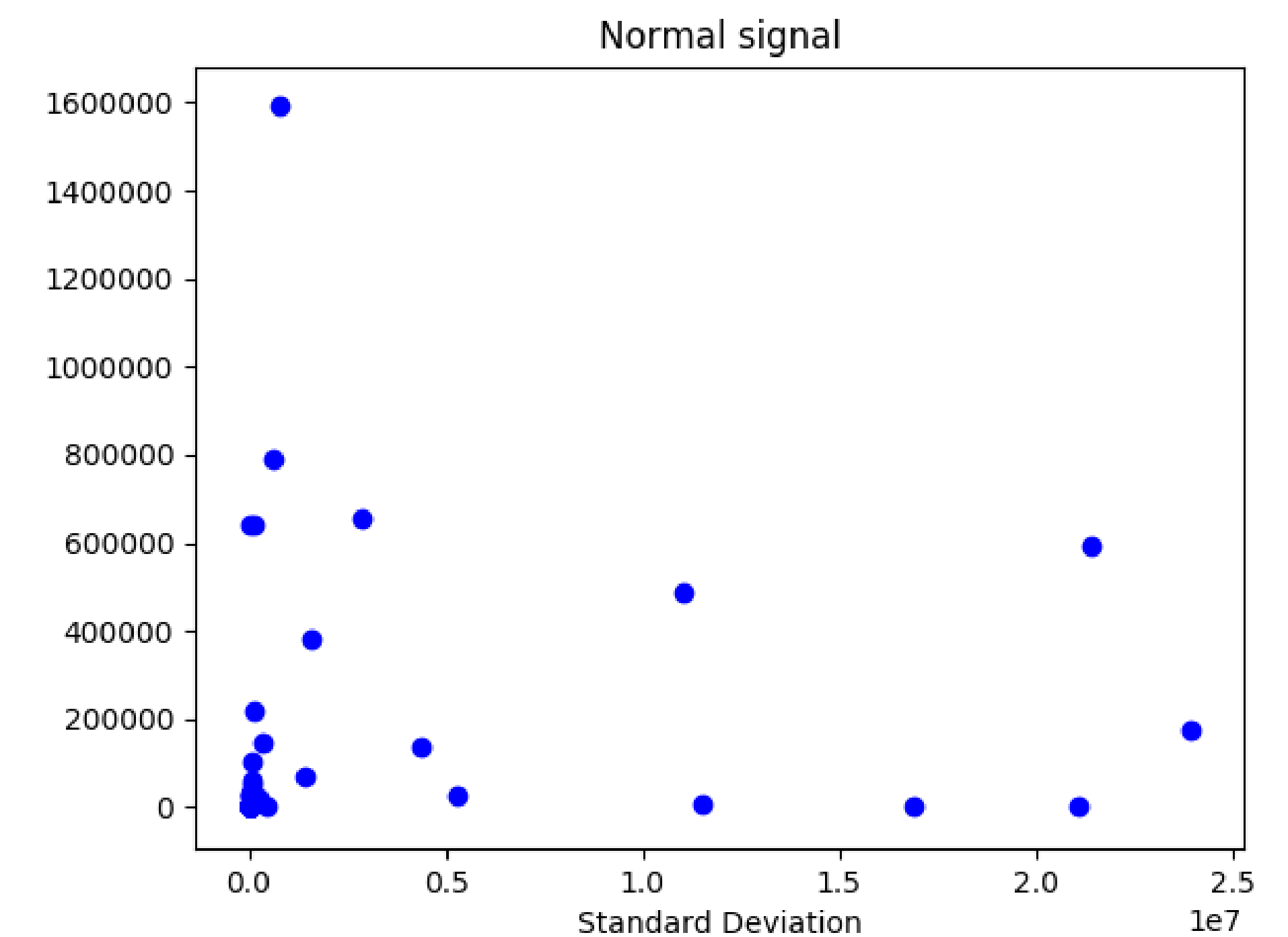


SIGNAL PROCESSING

- Use data clustering to classify filtered signals as healthy or pathological



CLASSIFICATION



REFERENCES

- [1] Guojun Zhang, Mengran Liu, Nan Guo, and Wendong Zhang, "Design of the MEMS Piezoresistive Electronic Heart Sound Sensor", *Sensors* 2016, vol. 16, issue 11, pg. 1728.
- [2] D. Chamberlain, et al., "Mobile stethoscope and signal processing algorithms for pulmonary screening and diagnostics", *IEEE Global Humanitarian Technology Conference (GHTC)* 2015.
- [3] Yi Luo, "Portable Bluetooth Visual Electrical Stethoscope research", *11th IEEE International Conference on Communication Technology*, 2008.
- [4] R. Palaniappan, et al., "A comparative study of the svm and k-nn machine learning algorithms for the diagnosis of respiratory pathologies using pulmonary acoustic signals", *BMC Bioinformatics*, 2014
- [5] R. Palaniappan, K. Sundaraj, N. Ahamed, "Machine learning in lung sound analysis: A systematic review", *Biocybernetics and Biomedical Engineering*, vol 33, issue 3, pg. 129-135, 2013

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