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Nathan Clairmonte

MSc Machine Learning Student

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Technical Experience

Vibrational Cardiography-based Respiratory Analysis **Aug 2020 — Dec 2022**
McGill University *Montréal, Quebec*

- Designed a vibrational cardiography (VCG) data collection system with respiratory and cardiac reference signals. System utilised an inertial measurement unit (IMU), a Raspberry Pi Zero, a **Flask** webserver and BIOPAC software.
- Collected data from 50 subjects. Data processing and feature construction done with **MATLAB**, **Pandas**, **NumPy** and **SciPy**.
- Designed and implemented **CNN's** to classify 40,000 VCG cardiac cycles by respiratory volume and phase, using **TensorFlow**.
- Achieved 99% and 84% accuracy on respiratory volume and phase classification, respectively.
- Resulted in multiple published academic studies ([1], [3] and [4] in the publications section) and a thesis.

Non-Invasive Physical Activity Monitoring System (NiPAMS) **Aug 2020 — May 2022**
McGill University/MDA (formerly MacDonald, Dettwiler and Associates) *Montréal, Quebec*

- Worked on a team attempting to extract blood pressure information from VCG signals.
- Initially achieved 60% average blood pressure prediction accuracy using an autocorrelated differential algorithm.
- Improved average blood pressure prediction accuracy to 87.5% by implementing **CNN's**, resulting in an approved patent for blood pressure prediction.
- CNN's were built, tested and optimized using **TensorFlow**, **NumPy**, **SciPy** and **Pandas**.
- Resulted in a published academic study on the research conducted ([2] in the publications section).

Patient Orientation Analysis and Heart Sound Detection with Vibrational Cardiography Signals **Aug 2020 — May 2021**
McGill University *Montréal, Quebec*

- Worked on teams attempting to quantify the effect of patient orientation on VCG heart rate estimation, and to detect heart sounds using VCG signals.
- Specifically, worked on data collection, data processing, and feature construction for these projects using **MATLAB**, **NumPy**, **SciPy** and **Pandas**.
- Resulted in two published academic studies ([5] and [6] in the publications section).

Software Developer/Chief Technology Officer **Dec 2019 — Aug 2020**
Stocate *Montréal, Quebec*

- Designed and built a mobile application to list nearby local businesses and their products.
- App was built using **React Native** and had garnered 60+ users at the time of my leaving.
- Participated in the conceptualization and design of new mobile application and website features.
- Helped design and build the company website, database and API using **React**, **SQL**, **.Net Framework** and **Google Cloud Platform**
- Implemented a feedback process for the website and mobile application which received 100+ responses.
- Managed incoming software interns by leading stand-ups and delegating coding tasks.

Senior Web Development Consultant **Jan 2017 — Dec 2019**
Latrecon Management Consulting *Montréal, Quebec*

- Designed and built company website using SquareSpace.
- Designed and built websites for 15+ clients.
- Worked regularly with clients to implement desired website changes.
- Helped to design and build a property database application using **React** and **JavaScript**.
- Managed incoming software interns by delegating website design tasks.

Skills

Languages	Python (fluent), MATLAB Script (fluent), JavaScript (fluent), SQL (proficient), TypeScript (proficient), Git (proficient), C# (prior experience), Java (prior experience)
Tools	MATLAB, SQL, Google Cloud Platform, AWS, React, React-Native, Node.js, Flask, .NET Framework
Packages	NumPy (fluent), Pandas (fluent), Keras (fluent), SciPy (fluent), TensorFlow (fluent), PyTorch (proficient)
Quantitative Research	Machine Learning, Deep Learning, Model Optimization, Biomedical Signal Processing

Education

Master of Science in Electrical Engineering (Machine Learning Research), *McGill University* Aug 2020 — Present
Bachelor of Engineering in Electrical Engineering, *McGill University* Aug 2015 — Dec 2019

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Publications

[1] **N. Clairmonte**, J. Skoric, Y. D'Mello, S. Hakim, E. Aboulezz, M. Lortie, and D. V. Plant, *"Neural Network-based Classification of Static Lung Volume States using Vibrational Cardiography,"* in Engineering in Medicine and Biology Conference, Montréal, 2020: IEEE.

[2] J. Skoric, Y. D'Mello, **N. Clairmonte**, A. McLean, S. Hakim, E. Aboulezz, M. Lortie, and D. V. Plant, *"Cuff-less Estimation of Blood Pressure from Vibrational Cardiography using a Convolutional Neural Network,"* in Computing in Cardiology Conference, Tampere, 2022.

[3] J. Skoric, Y. D'Mello, E. Aboulezz, S. Hakim, **N. Clairmonte**, M. Lortie, and D. V. Plant, *"Respiration Modulation of Sternal Motion in the Context of Seismocardiography,"* in IEEE Sensors, 2021.

[4] J. Skoric, Y. D'Mello, E. Aboulezz, S. Hakim, **N. Clairmonte**, M. Lortie, and D. V. Plant, *"Relationship of the Respiration Waveform to a Chest Worn Inertial Sensor,"* in Engineering in Medicine and Biology Conference, Montréal, 2020: IEEE.

[5] E. Aboulezz, J. Skoric, Y. D'Mello, S. Hakim, **N. Clairmonte**, M. Lortie, and D. V. Plant, *"Heart Rate Estimation from Vibrational Cardiography with Different Orientations,"* in Engineering in Medicine and Biology Conference, Montréal, 2020: IEEE.

[6] Y. D'Mello, J. Skoric, S. Hakim, E. Aboulezz, **N. Clairmonte**, M. Lortie, and D. V. Plant, *"Identification of the Vibrations Corresponding with Heart Sounds using Vibrational Cardiography,"* in Engineering in Medicine and Biology Conference, Montréal, 2020: IEEE.