June 21, 2021

Apple, Special Projects Group
Santa Clara Valley (Cupertino), California, United States
Re: Sensor Modeling, Simulation and Analysis Engineer

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Dear Talent acquisition manager,

I have always been fascinated by autonomous technology and have been conducting research into this field for about a decade. I believe that advancements in automation can reduce the need to focus on everyday mundane tasks giving people more freedom to focus on creative and innovative tasks. The Apple family has made major strides in this field and I would love to be exposed to some of the state-of-the-art autonomous systems developed by Apple. This will not only help me advance my career, but will allow me to contribute to groundbreaking technology that has a worldwide impact.

I believe that my research experience is well-aligned with the work being done at Apple R&D and the role that I would be filling. My PhD dissertation focused on design automation of aerospace structures and the use of optimization and advanced data visualizations (parallel coordinates and hypersurfaces) to explore thousands of design alternatives. I also used Monte-Carlo simulation techniques to estimate various design attributes such as reliability against uncertain loads and requirements. This work was translated into industrial practice during my research visits to GKN aeroengine systems where I hosted engineering workshops and presentations related to my research into design optimization and uncertainty modeling. My collective PhD experience will allow me to develop parametric evaluation frameworks for various sensor designs and configurations and conduct the necessary sensitivity analyses (using post-optimality analysis or multi-objective optimization) to get the most out of Apple's sensor technology.

I also conducted research visits to my alma mater, Khalifa University, where I worked on sensor fusion projects related to Unmanned aerial vehicles (UAVs). These drones are difficult to control using positioning systems (such as GPS and motion capture systems) due to their high latencies and low frequency signals. I managed to develop a sensor fusion algorithm for combining high frequency inertial measurement unit (IMU) signals with low frequency motion capture signals for attitude estimation. The estimated attitude can be transformed to an inertial reference frame to be used for control applications. This experience has provided me with the theoretical and practical knowledge needed for developing sensor fusion algorithms that can take advantage of the individual strengths of the available sensors on any given platform.

During my masters, I worked in the area of photonic sensors and waveguides for corrosion detection of oil and gas structures. I worked with various type of waveguides such as continuous glass fibers and fiber Bragg gratings which can be used for distributed and localized measurements, respectively. I used optical time-domain refractometry to interrogate fiber optic-based sensors and provide a spatial map of corrosion hot spots on steel structures. I used spectrometry techniques to interrogate fiber Bragg grating sensors and detect mechanical properties such as strain and temperature which are correlated to the corrosion rate of the structure they are affixed to. I constructed a novel testing setup for validating and verifying all the previous sensors under accelerated corrosion. I also developed a software tool in MATLAB and LabVIEW to calibrate the sensors and extract the relationship between various photonic effects (transduction) and corrosion rates (output signal). All of these skills are necessary for validating, verifying, and calibrating sensors tailored to the industry's needs.

Recently, I have been working with recurrent neural networks (RNNs) and encoder/decoder paradigms for forecasting COVID-19 pandemic trajectories for use in hospitals across Québec and have come up with an innovative way to tune such models (hyperparameter optimization) using stochastic optimization methods. I believe that deep learning paradigms based on RNNs can compliment existing signal processing tools at Apple pertaining to time series data or any signal where temporal effects are concerned.

I also have massive amounts of experience with scalable scientific computing and is able to leverage and use parallel computing libraries and APIs such as openMP and CUDA across multiple programming languages such as MATLAB, Python, and C/C++ which will be invaluable when it comes to sensor deployment and integration into Apple's software systems. I am also adept at maintaining and deploying code repositories using source control which will come in handy when partnering with different teams and subject matter experts on sensory algorithms.

Although I am happy with my current job working as a researcher at McGill and coming up with my own research ideas, I wanted to explore something different that I could only find at Apple. That is the opportunity to work with a multidisciplinary team and bring people's ideas together. I believe that my strong mathematical and simulation skills coupled with my experience in instrumentation and software development will add a lot of value to autonomous technology R&D at Apple and help us both realize our vision of a better tomorrow for everyone around the world. I hope you enjoy going through my profile and my projects on my website (https://khbalhandawi.github.io/projects/) and I hope there is mutual interest in an opportunity to work together.

Yours sincerely,

Khalil Al Handawi