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March 31, 2023

Air Canada, Dorval, Québec, Canada
Subject: Research Scientist - Operations Research and Optimization - 32669

Dear Hiring Manager,

I am writing to express my interest in the Research Scientist role within the Operations Research and Optimization team at Air Canada. I am excited about the opportunity to leverage my optimization, simulation, and modeling experience for advancing the commercial aviation sector and Air Canada's operations.

I understand that as part of the role, I will be solving business problems using various optimization techniques. I have relevant experience in the field of optimization as an instructor at McGill and as a researcher at McGill and Université de Montréal. I have 6 years of experience doing research on aerospace and aviation related projects at said institutions.

I am currently a post-doctoral research at the department of computer science and operations research (DIRO) at the Université de Montréal as part of an industrial project with the international air transport association (IATA). My current research focuses on graph representation learning from aviation data collected over the last decade to assess the effectiveness and impact of the IATA operation safety audit (IOSA) on air travel accessibility and cooperation between airlines.

Prior to this research project, I worked on aerospace design related projects, where I had to solve design optimization problems in relation to aeroengines. Although not within the scope of operations of Air Canada, I believe this experience is relevant as I had to use nonlinear programming and derivative-free optimization to solve various design problems. I also solved robust design optimization problems where some of the design requirements are modeled by probabilistic functions. I authored a Python library and a web application to support the design activities of our industry partner, GKN Aerospace engine systems.

I was also an adjunct lecturer at McGill University, teaching the engineering systems optimization course (MECH559) to engineering students. I covered various topics in optimization starting with basic theoretical foundations (FONCs and SOSCs), leading up to linear programming, nonlinear programming, sequential quadratic programming, multidisciplinary design optimization (MDO) (a kind of distributed optimization), and derivative-free optimization. As part of this course, I authored several notebooks in Python and Julia to help the students understand the implementation of said algorithms and solve real-world engineering problems in their projects.

I also worked on healthcare related projects, where I had to develop machine learning models for forecasting the trajectory of the pandemic. As part of these projects I used deep learning (with PyTorch) to build recurrent neural networks for the purpose of providing short term predictions.

I believe these experiences are relevant to the role in the following ways:

- I can apply machine learning and statistical modeling given my experience in surrogate modeling, graph representation learning, and deep learning.
- I can create software prototypes along with unit tests and documentation given my past experience authoring a Python library.

- I can investigate conflicts within datasets as I had to work with real-world data during the IATA and healthcare projects. I had to identify missing and conflicting data as part of data preparation to avoid introducing bias when applying learning algorithms to the data.
- I can develop and validate models (both simulation-based, and statistical) given my previous modeling and simulation experience during aerospace design, healthcare, and aviation related projects.
- I can apply mathematical optimization techniques given my optimization background and experience in research and teaching.
- I can establish and maintain effective business relationships as I managed to setup a research collaboration with IATA which allowed us to secure research funding through NSERC.

Thank you for considering my application. I would be honored to have the opportunity to discuss my qualifications further and show you my portfolio of projects. Please feel free to contact me through any of the channels at the top of this letter.

Best regards,

Khalil Al Handawi