ML HR dataset

With my PhD coming to an end I began to ask myself – what’s next? Having spent over a decade in various technical fields, I FINALLY had some semblance of understanding regarding the direction of technology and the ‘state of the art’. In my mind, there was no bigger opportunity than in the field of artificial intelligence. With the explosion of big data and cluster computing, the current opportunities of ML seem endless. Having spent most of my academic and professional career engineering for the optimal process/design, coupled with my experience in algorithm development, it appeared that I was built for building ML platforms for optimization problems.

With that being said, I co-created a startup called Alitheia Technologies Inc, and partnered with friend who has an amazing business and sales acumen – thus creating a multi-disciplinary team that was ready to tackle the upcoming AI revolution. This company is centered on a platform I developed called Tailored Process Optimization (TPO), which can be thought of as the brain child of Lean-Six Sigma, ML and process optimization.

In our first case study, we looked at an HR dataset for a potential client and analyzed attrition. The outcomes of the model were vast, and truly surpassed our expectations. TPO was capable of generating an optimal candidate based on historical data, rank the current employees based on their risk of attrition, and provide strategic recommendations on how to best minimize attrition for high risk employees. The application of TPO is vast, and although my summary is brief, feel free to contact me, if you would like to know more.

Optimized Nozzle configuration

This project was centered on AI design for the manufacturing sector. The objective of this project was to use ML to design the best possible nozzle for abrasive waterjet machining (AWJM). I presented this work at the 23rd International Conference on Waterjetting in Seattle (<a href="https://www.researchgate.net/publication/312176634\_Optimized\_abrasive\_waterjet\_nozzle\_design\_using\_genetic\_algorithms"> Optimized abrasive waterjet nozzle design using genetic algorithms</a>). Due to the very violent nature and complex flow phenomena associated with AWJ’s, nozzle optimization has relied on the classical iterative design process… until now.

This project all started when I read a very interesting paper by Dr. Narayanan et al. called <a href="http://www.sciencedirect.com/science/article/pii/S0924013613002112" > Modelling of abrasive particle energy in water jet machining </a>. In this paper, they present a 1D computational fluid dynamics (CFD) model for predicting abrasive particle velocities within 5% error. For anyone that knows anything about CFD, modelling a 3 phase, supersonic, compressible flow is just about the last thing you want to tackle, let only getting only 5% error. In seeing how revolutionary this model was, I reached out to Dr. Narayanan, who graciously allowed me use of his model. Since I have already linked the paper, the rest is pretty much history. In summary, we used evolutionary ML algorithms to develop an optimization program. The output of the program was an optimal nozzle design configurations (i.e. nozzle and orifice diameters, mixing chamber sizes, etc); which generated, on average, a 15% increase in cutting efficiency!

Optimized Winglet Design

My early academic and professional career was focused on aerospace engineering applications. Ever since receiving my glider and private pilots license in my teens, I was hooked on learning everything I could about the development of flight – plus the title of being an Aerospace Engineering sounded pretty cool!

At the end of my undergraduate career, I had the opportunity to work on a research team that was developing AI design systems for a light aircraft manufacture. My role on the team was to develop an intelligent winglet design module. The objective was to take a generic airfoil and wing shape, and based on the various flight characteristics (i.e. airspeed, angle-of-attack, altitude etc.) of that aircraft, have my expert system design the best possible winglet. Having gone through the frustrating iterative design process in many case projects, I was eager to create something that would make my life easier and produce potentially better designs.

The model worked using MATLAB and an API between a CFD vortex lattice simulator called AVL. The dimensions of the winglet would be generated through my ML program, which was then fed into AVL, which would then output the various lift and drag metrics for that specific wing/winglet configuration. The model would then tune the winglet design to maximize the lift-to-drag ratio. As seen from the before and after photos in the header image, the ML program created considerable design improvements, resulting in a 12% increase in performance!

Optimized Composite Layup

Classical lamination Theory Matlab

Micro Piercing Borosilicate Glass

Qualitative assessment of Machining with AWJ

Usability Study

Classica Lamination Theory Program

Seneca Projects

CFD impact project, both impact and exit peeling

Weighted Functions in Fracture Mechanics (in google drive as Stress intensity factors code)

Design of abrasive flow rate regulator

Contact force of waterjet (Advanced Mech of Materials)

Micro and Nano Manufacturing Midterm review Notes

Design of a Clamping device

DDA

Flow over an airfoil simulation (undergrad work)

SAE Baja Design stuff