Andrea Nicolas

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Research engineer with over 8 years of expertise in probabilistic design, machine learning, and model validation, applying advanced methods to real-world challenges in aerospace, semiconductor, and energy sectors.

Skills

Technical

- Probabilistic Design: Bayesian Optimization, Gaussian Processes (GP), Monte Carlo Simulations.
- Machine Learning: Time series forecasting, Feature Engineering, dimensionality reduction (PCA).
- Data Analytics: cleaning, manipulation, scraping, visualizations (seaborn, matplotlib), model calibration & validation.
- Statistics: descriptive/inferential, non-Gaussian distributions, UQ (Uncertainty Quantification), design of experiments.
- Project Management: SCRUM, version control, code documentation, unit testing, linting.

Software

- Languages and libraries: Python (scikit-learn, pytorch, numpy, pandas, scipy), C++, MATLAB, Bash, LaTeX.
- Data and workflow management: Git, PostgreSQL, Docker, MLflow, Prefect, Grafana, AWS, HDF5.
- Design and Simulation: COMSOL, ANSYS, Xpedition Layout, SolidWorks, Finite Element Analysis (FEA)

Professional Experience

Mar 2021 – Present | Research Engineer | Intel Corporation | Phoenix, AZ

- Created a **regression model** to predict manufacturing risk early in the product lifecycle, **reducing resource waste by 30%** by prioritizing high-viability projects and enhancing late-stage performance. Feature engineering and PCA used.
- Applied **probabilistic methods** and multi-objective **Bayesian optimization** to recommend optimal product designs and manufacturing processes, **achieving 100% performance targets** compared to 50-75% with manual methods.
- Refactored the main software engine and streamlined the overall pipeline, simplifying a 3-month+10 engineer process to a 1-week+1 engineer process. Vectorization and parallel processing were used to speed up core software.
- Implemented version control, regular documentation, **unit testing, e2e testing**, and SCRUM.

Sep 2019 – Mar 2021 | Postdoctoral Researcher |Argonne National Laboratory | Lemont, IL

- Developed a **probabilistic failure prediction model** for high-temperature nuclear vessels using **Monte Carlo + GP**. The training data was generated via non-Newtonian FE models of vessels to **improve runtime by 30x**. See [1].
- Developed “GOOSE” to predict the failure probability in nuclear graphite cores, enabling engineers to rate core quality and establish its operational limits and maintenance requirements. See [2].

Jun 2014 – Aug 2019 | Research Assistant | Purdue University | West Lafayette, IN

- Generated a **crack prediction parametric model** using feature engineering and large datasets (60M+ datapoints) of aerospace material data. The model accurately **predicted** the crack initiation site for **4/4** of test case scenarios. See [3].
- The model showed that cracking resulted from the joint effect of microstructure, localized stress, and corrosion profile.
- Stress/strain calculations done with FFT, data analysis done via **GP + Principal Component Analysis**, data via HDF5.

Personal Projects

Jun 2024 – Present | Canadian Immigration CRS Cutoff Predictor

- Developed a time series forecasting model to predict Canadian immigration score cutoffs. The final model showed similar performance to state-of-the-art models with 60x faster runtime and easier redeployment. See [4].
- Implemented best **DevOps** practices for model creation, deployment & monitoring via Docker, MLflow, Prefect, Grafana.

Education

PhD Aerospace Engineering, Purdue University, 2019 – Bilsland Fellowship recipient and AeroAssist President.
MS Aerospace Engineering, Purdue University, 2016 – Chair of graduate student group “AeroAssist”.
BS Aeronautics Engineering, Universidad Aeronautica en Queretaro, 2013 – DHL Academic Excellence award.

Sources

[1] report: https://publications.anl.gov/anlpubs/2020/09/161948.pdf
[2] repository: https://github.com/Argonne-National-Laboratory/goose (report: https://publications.anl.gov/anlpubs/2020/08/161661.pdf)
[3] article: https://www.sciencedirect.com/science/article/abs/pii/S0013794419303005
[4] repository: https://github.com/anicolas91/CRScanada_MLOps