Nozhan Balafkan

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Education

Aug. 2016 - June 2018	Master of science in physics (energy and climate), University of Tromsø, **Norway**
Sep. 2014 - Sep. 2015	One-year post-master research in computational astrophysics, Saint Mary's University, Halifax, **Canada**.
Apr. 2011 - Nov. 2013	Master of science in physics, International Physics Studies Program, University of Leipzig, **Germany**.

Work Experience

2020 - present   **Data Scientist at StormGeo (Norway/Bergen)**

Project Title: GridEyes. Power line monitoring with satellite imagery and AI.

Key Contributions:

- **Extreme Weather Modelling**: applying **extreme values** statistical methods to detect and model extreme wind events for improved risk assessment.
- **Object Detection and Segmentation**: utilised **TensorFlow** for precise object detection and segmentation in satellite imagery, enabling the identification of vegetation.
- **Image Enhancement**: employed **PyTorch** for deep **super resolution-based** meteorological data downscaling and image enhancement, resulting in information projection from 900 km^2 to 6 km^2 for enhanced detail and accuracy.
- **Imagery Analysis**: conducted extensive pre-processing, post-processing, and texture analysis of satellite imagery using the **Scikit-image** library.
- **Vector Data Analysis**: leveraged the **Shapely** library for comprehensive vector data analysis, aiding in geospatial understanding and correlation.
- **Cartographic Expertise**: proficiently performed cartographic projections and precise coordinate conversions using the **Pyproj** library, enhancing the project's geospatial accuracy and applicability.

2019 - 2020   **Data Scientist at Capgemini (Norway/Oslo)**

Project Title: Car Detection in High Resolution Satellite Imagery (POC).

Description: parking space availability and traffic estimation in the city of Toronto using deep learning and high resolution satellite imagery.

Key Contributions:

- **Object Detection**: extensive use of deep learning-based object detection models and application of **scikit-image** library for data processing and data augmentation.
- **data visualisation**: making use of QGIS software for geographical information system (GIS) analysis and visualisation of the data.

Project Title: Motorcycle Safety Enhancement Proof of Concept (POC).

Description: developed a proof of concept (POC) system using deep learning to enhance the safety of motorcycle riders when approached by speeding police cars. The POC incorporated onboard cameras and an Nvidia Jetson Nano kit, mounted on an electric motorcycle.

Key Contributions:

- **Object Detection**: made extensive use of **YOLO** object detection model.
- **Signal Integration**: integrated the detection system with a visual alert mechanism involving a diode, placed within the motorcycle driver's helmet.
- **Hardware Setup**: utilised an Nvidia Jetson Nano kit for the computational power needed for real-time inference. The system was securely mounted on an electric motorcycle for field testing.

Project Title: Ground Motion Area Detection Proof of Concept (POC).

Description: employing interferometric synthetic aperture radar (InSAR) techniques to the Sentinel-1 data and application of the SNAP library to detect ground motion areas in **millimeter** precision over Oslo.

Key Contributions:

- **Sentinel-1 Satellite**: ingestion and preprocessing of SAR data for a period of one year to monitor ground motion in Oslo with precision and reliability.
- **SNAP Library**: leveraged the SNAP (Sentinel Application Platform) library for InSAR analysis, facilitating data analysis and interpretation.

Awards

Winner of the best idea of the month in the economic operators' activity category. A COVID-19 custom script contest arranged by the European Space Agency (ESA) and the European Commission.

Computer Skills and Certificates

- Programming language: Python, C++, Bash, Fortran

- Python packages: Scipy, Numpy, Pandas, Matplotlib, Pyro, Pytorch, TensorFlow, Scikit-learn, Scikit-image, Emcee, GeoPandas, shapely

- Softwares: QGIS, ESRI ArcGIS

- Version control system: Git

- Data visualization: Matplotlib, Houdini

- Certificates:

    - AWS Certified Machine Learning - Specialty (in progress)
    - AWS cloud practitioner (AWS)
    - Convolutional Neural Networks (Coursera)
    - Structuring Machine Learning Projects (Coursera)

- Neural Networks and Deep Learning (Coursera)
- Improving Deep Neural Networks; hyper-parameter tuning, regularisation and optimisation (Coursera)
- Deep learning A to Z (Udemy)
- Machine learning A to Z (Udemy)
- GIS Data Formats, Design and Quality (an ESRI ArcGIS series)
- Fundamentals of GIS (an ESRI ArcGIS series)

Statistical Analysis Skills

- Generative AI models:
  - Flow-based models (e.g. NICE, Real NVP, and GLOW)
  - LVM-based models (e.g. Variational Auto Encoders)
  - Diffusion-based models
  - Graph Neural Networks (GNNs)

- Regression Analysis:
  - Linear and Non-Linear Regression
  - Generalized Linear Models
  - Generalized Additive Models
  - Linear Mixed Models

- Hypothesis Testing and Estimation:
  - Hypothesis Testing
  - Confidence Interval Estimation

- Time Series Analysis:
  - Autoregression Methods
  - Lags Analysis

- Bayesian Statistics and Probabilistic Modelling:
  - Bayesian Linear Models
  - Bayesian Generalised Linear Models
  - Bayesian Inference

Publications

- Automated Satellite-Based Assessment of Hurricane Impacts on Roadways. M. Gazzea; A. Karaer; M. Ghorbanzadeh; N. Balafkan; T. Abichou; E. Erman Ozguven; R. Arghandeh Published on IEEE (2022), Volume: 18, Issue: 3.

- Analyzing COVID-19 Impacts on Vehicle Travels and Daily Nitrogen Dioxide (NO2) Levels among Florida Counties. A. Karaer; N. Balafkan; M. Gazzea; E. Erman Ozguven; R. Arghandeh Published on Energies (2020), Volume: 13, Number: 22.

- A large sample of Kohonen-selected SDSS quasars with weak emission lines: selection effects and statistical properties. H. Meusinger & N. Balafkan. Published on Astronomy & Astrophysics (2014), Volume 568, A114.