Erik C. Duncan

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EDUCATION

Master of Science, Geoinformatics, University of Copenhagen, Department of Geosciences and Natural Resource Management

Sep 2019 — Sep 2021

- **M.Sc. Thesis** "Detecting Artillery Craters in Conflict Zones with Semantic Segmentation Convolutional Neural Networks".
- Supervised by Dr. Alexander Prishchepov.
- I applied deep learning approaches developed for medical imaging applications to very high resolution (VHR) atmospherically corrected Maxar (WorldView 2/3 at 0.3-1 m resolution) imagery for the individual detection of artillery craters in Ukraine. Results of crater detection lead to highly accurate unexploded ordnance (UXO) estimation across large spatial areas of the conflict.

Bachelor of Science in Geomatics, with Honours, Carleton University, Department of Geography and Environmental Studies

Sep 2015 — Nov 2018

- Skills in ArcGIS, Excel, SQL, R, python, Geomatica. Courses in traditional computer science, geography, statistics, natural sciences, and engineering. Team projects for Canadian Government initiatives.

APPOINTMENTS

Faculty Specialist, University of Maryland, Department of Geographical Sciences

40hrs/wk Oct 2021 — Present

SUMMARY

- **CO-I. NASA Rapid Response**
  - NASA Rapid response project: "Artillery Craters and Unexploded Ordnance Mapping in Ukraine using High Resolution Satellite Imagery"
  - Project awarded March 2023.
  - Large scale data processing and deep learning implementation in conflicted areas of Ukraine.
- **CO-I. Airforce/DoD STTR**
  - STTR Project "Revolutionizing Space-Based ISR through Decentralized Systems and In-Orbit ML Computing for Near-Real-Time Intelligence"
  - Project awarded February 2024.
  - Adapting machine learning capabilities to function onboard optical imaging satellites with computational and power constraints.
- **NASA Harvest**
  - Providing Damage assessment work for NASA Harvest project.
  - Liaising with partners in FAO and Ukrainian government for delivery of vital agricultural damage information.
  - in 2023, agreements made with partners for large scale damage assessment with data sharing for Ukrainian agricultural policy.
- **Project: "High-Impact Hot Spots of Land Cover Land Use Change: Ukraine and Neighboring Countries"**
  - I work on the multi-year NASA-funded project for remote sensing monitoring of Ukraine.
  - Research focuses on the detection of artillery and rocket craters in VHR satellite imagery using deep learning techniques.
  - Developed an image processing pipeline with python that leverages multiprocessing and cluster computing for top of atmosphere image correction, precise orthorectification, pansharpening, and object detection.
  - Publication under review in Science of Remote Sensing.
  - Able to process multi-terabytes of data for rapid analysis of current UXO extents in contemporary imagery.
  - Mapped 33,000 km^2 of UXO hazards across Ukraine.
  - We partner with the FAO, Ukrainian Ministry of Agriculture, and Planet labs through the NASA Harvest program.
- **IARPA SMART Program**

- Project member of the University of Maryland/Kitware team for the project, focusing on very high resolution image processing and machine learning approaches for project phase 1.
- Research focused on training and deploying deep learning techniques for cloud compensation in multi-source VHR imagery.
- Evaluated new methods and technical approaches within the project scope.

- **Techincal Knowledge**
  - Remote sensing and GIS applications QGIS, ESRI ArcMap/ArcGIS Pro tools, Python Toolboxes and Modelbuilder
  - Python: including GDAL, scikit-learn, tensorflow, fiona, rasterio, geopandas, numpy, multiprocessing
  - Maxar Worldview 2,3, Geo-eye, Planet Skysat, Sentinel 2, Landsat, MODIS

OTHER EXPERIENCE

Founder   **Jan 2020 — Jan 2021**
Altus Monitoring Solutions   Copenhagen, Denmark

- Providing UAV and satellite analysis and technologies for insurance applications. Member of the University of Copenhagen's Innovation Hub for startups.
- The startup was accepted for the European Space Agency Launchpad event, where the team grew to four members. We continued to develop the project while working on our various other pursuits.

Satellite Mapping Analyist   **40hrs/wk Sep 2018 — Jul 2019**
Geological Survey of Canada | Natural Resources Canada   Ottawa, Canada

- Joined the Arctic division of the Geological Survey of Canada as a satellite mapping analyst.
- Focused on a multi-year geohazard mapping project along the new Tuktoyaktuk Highway in the Yukon and Northwest Territories of Canada. Using high resolution optical satellite imagery, my tasks included imagery analysis, database management, technical writing and editing of government documents, along with research and experimenting with new mapping techniques.
- Bilingual office, necessitating communication in both English and French.

Geomatics research science practicum   **16hrs/wk Jun 2018 — Sep 2018**
Geological Survey of Canada | Natural Resources Canada   Ottawa, Canada

- Completed a Geomatics Research Science Practicum with the Geological Survey of Canada as a GIS analyst in the Permafrost section, with permafrost researcher Dr. Stephen Wolfe.
- Project aimed to estimate carbon and water volumes in Arctic permafrost landforms using mathematical, remote sensing, and vector based approaches to permafrost modelling.
- These approaches are being developed for future government publications in the department by Dr. Wolfe and the team.

OTHER INFORMATION

Personal Website   **2017 — Present**
- **Project Portfolio**
  - In 2017 I began cataloguing my personal and mapping projects onto a website. The projects range from using deep learning to enhance 100 year old films, to making art with maps. The website gives a good description of my recent projects.
  - **Click here to explore**

PUBLICATIONS

2023   **Detection and mapping of artillery craters with very high spatial resolution satellite imagery and deep learning**

AWARDS & HONORS (CLICK TO LEARN MORE)

2024   FAO Meeting with Ukrainian Govt. Rome, IT
2023   Oral presentation at AGU 2023, San Francisco; NASA Harvest meeting and presentations, Strasbourg France; NASA LCLUC meeting, College Park, MD; World Bank ICAS IX Conference, Washington DC: Trans-Atlantic Training workshop, Brno, CZ; GICHD Innovation Conference, Geneva, CH
2022   ESA Living Planet Symposium Poster Presentation on UXO hazard mapping; AGU 2022 Poster Presentation, Chicago Il
2021   **Global University Climate Forum Team "Yes We Canteen"**
2020   **NASA Space Apps Challenge regional winner: project "AfterFire"**; **European Space Agency Launchpad participant**