

Zachary Komarnisky

Carstairs, Alberta | 403-994-2797 | zachkom@telus.net
github.com/Dozer3530 | linkedin.com/in/zachary-komarnisky

PROFESSIONAL SUMMARY

Digital Agriculture researcher and developer building open-source tools for Canadian precision agriculture. Current focus is the RETA research — cleaning agricultural geospatial data, and its machine-learning extension RETA-ML for spatial outlier detection — alongside Kestrel, a geospatial data inspector. Experienced across the full agricultural data pipeline, from field data collection to spatial analysis and ML-driven decision support.

TECHNICAL SKILLS

AI & Machine Learning

- Python (PyTorch, PyG), Graph Neural Networks (HeteroGAT), XGBoost
- Optuna hyperparameter optimization, focal loss, temperature scaling/calibration
- Scikit-learn, Pandas, NumPy

Data Aggregation & Pipelines

- Multi-source data integration (satellite, weather APIs, soil, elevation)
- GeoPandas, pyproj, Shapely, spatial analysis
- REST APIs (Open-Meteo, Copernicus CDSE), concurrency, SQLite/GeoPackage/Parquet/GeoTIFF

GIS & Remote Sensing

- QGIS (plugin development), ArcGIS, Sentinel-2 imagery
- NDVI, NDWI, False Colour composites, DEM processing
- Drone/UAV data processing, Pix4D, Emlid, Trimble Catalyst

Tools & Platforms

- Git/GitHub, GitHub Actions CI/CD
- Linux (Ubuntu), Jupyter Notebook, PyCharm
- PySide6, FastAPI, CustomTkinter

PROJECTS — OPEN SOURCE

SMSLIBRE github.com/Dozer3530/SMSLIBRE

- QGIS plugin importing manufacturer machine data (yield, as-applied, as-planted, boundaries) from John Deere GS2/3/4, ISOXML incl. New Holland and AGCO, and Raven Slingshot — every logged sensor channel preserved as an attribute, output to GeoPackage and auto-styled. Built for the Olds College Centre for Innovation Smart Farm
- Python QGIS plugin driving a self-contained .NET/C# sidecar over JSON subprocess, hosting the AgGateway ADAPT plugin suite; isolating the CLR keeps a vendor-library crash from taking QGIS down and keeps the plugin cross-platform. Real cards import at 550k+ points and up to 598 channels

CropCore github.com/Dozer3530/CropCore

- Desktop analytics pipeline aggregating Sentinel-2 NDVI, Open-Meteo weather, CDEM/SRTM elevation and Alberta Open Data soil into per-field and farm-level reports (PDF, HTML, CSV, NDVI time-lapse)
- Field stress index (0–100), review priority ranking and linear regression yield forecasting (wheat, barley, canola) with drought-stress penalties and $\pm 20\%$ confidence intervals

RETA-ML github.com/Dozer3530/RETA-ML

- Outlier detection for spatial agricultural sensor data; 4-class classification (Clean, Operational, Global Outlier, Local Outlier) with pure Python/GeoPandas preprocessing, no QGIS dependency
- Ships trained Random Forest and XGBoost models with a model card (49,665 training points, 13 features) and a Streamlit app to run them on new fields; a HeteroGAT graph network over temporal, spatial and transect edges is the spatially-explicit next step

RETA — Robust Error-treatment Toolkit for Agriculture github.com/Dozer3530/RETA

- Unified algorithmic framework for cleaning yield monitor and spatial agricultural data via 3-phase sequential pipeline (Operational → Global → Local errors)
- CRS-aware via optional pyproj with a Haversine fallback; full pipeline runs as a QGIS Processing algorithm, with a headless DataCleaner for global/AOI filtering

Waxwing github.com/Dozer3530/Waxwing

- Management-zone builder for Alberta/Saskatchewan fields: multi-year Sentinel-2 index history (NDVI, NDRE, GNDVI, MSAVI2 or bare-soil) clustered into stable productivity zones — balanced-breaks clustering with zone-size floors, silhouette-guided zone count, split-half and leave-one-year-out validation
- Carries through to soil sampling design (10 schemes incl. conditioned Latin hypercube) and N/P2O5/K2O/S variable-rate prescriptions from provincial guidelines

Albatross github.com/Dozer3530/Albatross

- Local Sentinel-2 field monitoring console; auto-scans Copernicus for new L2A acquisitions, downloads only the pixels inside each boundary, and computes NDVI and NDWI at 10 m with SCL cloud masking — float32 GeoTIFFs, colormap and true-colour PNGs and a mean-index timeline, all stored locally

Lapwing github.com/Dozer3530/Lapwing

- Sentinel-2 L2A imagery downloader for field boundaries; cloud-filtered Copernicus retrieval exporting RGB, NDVI, NDWI, False Colour and DEM as analysis-ready GeoTIFFs clipped to the field, plus a multi-year historical NDVI composite over a seasonal window

Kestrel github.com/Dozer3530/Kestrel

- Diagnoses why geospatial layers fail to display — ~48 checks for missing/undefined CRS, coordinate-CRS mismatch, out-of-zone data, invalid geometry — across OGR/GDAL formats, ArcGIS REST services (flagging published extents that do not match the data) and .lyrx/.mapx layer files (broken links, scratch-GDB sources)
- Non-destructive repair (assign CRS, reproject, fix geometry, convert format, CSV/Excel to point layer), plus a whole-folder audit with CSV/HTML export and a JSON CLI that exits non-zero on error for CI use

Magpie (*Private repository*)

- Weekly crop-monitoring package builder merging Survey123 observations, PT2R lab nutrient data and Pest ID bug counts into Excel and GeoPackage deliverables; PySide6 + FastAPI on a shared service layer

Perch github.com/Dozer3530/Perch

- Windows GUI for sorting multispectral MicaSense drone imagery into band-specific folders; auto-detects camera from EXIF, parallel processing, PyInstaller single-file distribution

Plover github.com/Dozer3530/Plover

- QGIS plugin (v3.2.5) for boundary-aware Travelling Salesperson routing — visibility-graph shortest paths that stay inside the field and route around sloughs and exclusion zones; multi-start nearest-neighbour with 2-opt/Or-opt, GPX/KML export, and a registered Processing algorithm for batch and PyQGIS use

RESEARCH & PUBLICATIONS

A Machine Learning Framework for Automated Anomaly Detection in Precision Agriculture Geospatial Data

Poster presentation — 17th International Conference on Precision Agriculture / 11th Brazilian Congress on Precision and Digital Agriculture (ICPA/ConBAP) — Porto Alegre, Brazil, July 2026

- Co-authored with Felipe H. S. Karp (Olds College); funded by an NSERC CCI Mobilize Grant
- Built a ~50,000-point expert-annotated dataset across three sensors (EM38, Veris 3100, GreenStar combine yield monitor) from the Olds College Smart Farm
- Evaluated Random Forest and XGBoost under leave-one-sensor-out cross-validation; findings directly inform the graph neural network approach used in RETA-ML

WORK EXPERIENCE

Olds College Centre for Innovation

Research Assistant

Olds, AB

Summers 2025 & 2026

- Collected and processed field data using drones, soil moisture probes, and GPS equipment across multiple applied research projects with senior researchers and industry partners
- Provided technical support and troubleshooting for precision ag sensors and equipment in the field

Town of Carstairs — Operational Services

Seasonal Labourer

Carstairs, AB

2022–2024

- Operated landscaping and maintenance equipment; facility and infrastructure upkeep

EDUCATION & CERTIFICATIONS

Olds College of Agriculture and Technology

Bachelor of Digital Agriculture

Olds, AB

Expected 2027

Co-Curricular Record: Student Research Experience, 2026

Small RPAS Pilot Certificate — Basic Operations (VLOS), Transport Canada, 2025