Gregory Baluev

Architect & Computational Designer — Zoning Feasibility, Spatial Data, AI-Assisted Tools

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SUMMARY

Architect (BArch) and computational designer with 8 years across architecture, urban design and design software. Builds tools that turn building and zoning rules into clear answers — from generative housing tools and a design-code plugin to a Montreal zoning capacity engine with versioned, sourced rules and LLM-assisted bylaw extraction.

CORE STRENGTHS

Zoning feasibility	Bylaws modelled as versioned, sourced rule data; parcel-level capacity analysis comparing what zoning allows with what is built.
Plain-language output	Every rule carries its source and a certainty level, so results can say “not known yet” instead of guessing.
Codes into tools	8 years across architecture, urban design and computational design; design codes and building norms (insolation, density) built into tools such as SISU and residential design generators.
Geospatial data	Messy public sources (parcels, rolls, permits, LiDAR) into tested PostGIS pipelines.
Practical AI	LLM-assisted bylaw extraction evaluated against official sources; end-to-end ML pipelines (XGBoost, PyTorch, MLflow, SHAP).

INDEPENDENT PROJECTS

mtl-realestate-intel — Montreal Zoning & Property Data Platform — 2026 – Present

Python · PostgreSQL / PostGIS · Docker · LLM extraction · private repository, demo on request

- Built a parcel-level zoning capacity engine comparing allowed vs. built form on each lot, using LiDAR building geometry from mtl-roofs.
- In progress: a versioned zoning-rules layer with provenance — source, certainty, and in-force vs. recorded dates for every fact. It matches the previous zoning model exactly on ~9,000 lots, and LLM-extracted bylaw values matched official sources 493/493.
- Integrated 5 public sources — municipal and provincial property rolls, building permits, 2021 census and zoning — into a PostGIS platform of nearly 3M records, with logged, safely re-runnable loads under docker-compose.
- Built automated PDF report pipelines (Jinja2, WeasyPrint) as a typed Python library with all-or-nothing writes and a data-staleness gate; GitHub Actions runs ruff and pytest on every PR.

mtl-roofs — LiDAR to LOD2 Roof Reconstruction — 2026 – Present

Python · PDAL · PostGIS · github.com/grigorybaluev/mtl-roofs

- Built a classical pipeline reconstructing Montreal building roofs from open aerial LiDAR and footprints: RANSAC + total-least-squares plane detection, a constrained nonlinear least-squares topology solver, and watertight LOD2 extrusion.
- Built an evaluation harness scoring every building against the city’s independent 3D model (vertical RMSE, plane orientation, topology, coverage) with a per-building failure log; CI enforces mypy --strict, 240+ tests and a metrics regression guard.
- Feeds measured building geometry into the mtl-realestate-intel capacity engine as the “built” side of allowed vs. built.

Building Energy Forecasting & HVAC Control Simulation — 2026 – Present

Python · XGBoost · PyTorch · MLflow · github.com/grigorybaluev/building_energy_project

- Built an end-to-end ML pipeline forecasting hourly electricity load for 435 office and education buildings (7.6M rows); XGBoost reached R^2 0.95 / MAPE 7.2% on a held-out, time-based test split, with a PyTorch LSTM baseline.
- Simulated rule-based vs. weather-adaptive HVAC control over the forecasts; TreeSHAP showed building characteristics explain <2% of forecast attribution but predict which buildings are hard to forecast (size vs. error $\rho = -0.23$, $p < 1e\text{-}5$).

PROFESSIONAL EXPERIENCE

Web Developer — **Montreal Assembly** Montréal, QC · Aug – Dec 2024

- Built a web-based 3D product configuration application end to end: JavaScript/HTML/CSS front end, libSQL data layer, and Python and Blender tooling to prepare and export its 3D models.

Computational Designer — **Aective** Moscow, RU · Feb 2022 – Mar 2023

- Built generative design tools for multi-storey residential development — block layout, section and facade generators — in Python against a PostgreSQL data layer, with BIM export.
- Integrated insolation (sunlight) analysis into the generators, so every scheme was checked against Russia's mandatory insolation norms as it was generated.
- Designed the tools for non-technical users, working across architects, engineers and BIM specialists.

Computational Designer / Architect — **design::unit** St. Petersburg, RU · Jun 2018 – Feb 2022

- Started in urban design and master planning — site and context analysis on projects shaped by zoning and building norms (density, insolation) — then moved into computational design: form finding, analysis and parametric systems.
- SISU: built the CAD algorithms and data management behind a design automation and optimization plugin for architects and urban designers. It applies a design code — a library of materials and elements plus rules for combining them — semi-automatically; later extended into a Rhino/Grasshopper-to-Revit plugin.
- Ecopolis: built the geospatial data layer and 3D web visualization for the Korsakov metropolis expansion plan, integrating Mapbox, Three.js and QGIS-processed municipal data.

Freelance Computational Designer — **part-time, during BArch** St. Petersburg, RU · 2015 – 2018

- Construction inspection jobs with on-site computational modelling, applying computational design to construction processes; freelance computational modelling, interior design projects and urban design competitions.
- Urban research with mixed methods — participatory design, micro-urbanism, urban acupuncture — and art installations with artists.
- Taught 3D software courses, managed an art residency, and organised educational, competition and social events for architects and urban designers.

TECHNICAL SKILLS

AI & ML	LLM-based document extraction and evaluation, AI-assisted development (Claude Code), pandas, NumPy, scikit-learn, XGBoost, PyTorch, MLflow, SHAP
Geospatial & data	PostgreSQL / PostGIS, GeoPandas, Shapely, PDAL, H3, QGIS, Mapbox, SQLAlchemy
Programming	Python, SQL, TypeScript / JavaScript, Java, C, Swift, HTML / CSS
Engineering	Git, GitHub Actions, pytest, Docker, Poetry, Jinja2, WeasyPrint, Three.js
Design & 3D	Rhino 3D / Grasshopper, Revit, AutoCAD, Blender, Adobe Creative Suite (Ps, Ai, Id, Pr)
Languages	English (fluent), Russian (native), French (beginner)

EDUCATION

BCompSc, Joint Major in Data Science — **Concordia University, Montréal** 2025 – Present

Diploma in Mobile Application Development — **CICCC, Vancouver** 2023 – 2025

Master of Data Science, one year of coursework — **Higher School of Economics, Moscow** 2021 – 2022

Bachelor of Architecture (BArch) — **St. Petersburg State Univ. of Architecture & Civil Engineering** 2012 – 2018