Data-Driven Landmark Identification with Machine Learning in non-urban areas

Bachelor- or Masterthesis

Motivation

- Rural navigation benefits from landmark-based systems
- Existing models rely on rule-based models → limited scalability
- Crowdsourced geographic data are underutilized
- Aim: learn landmarks from data bridging human perception, GIS, and machine learning



Own photographs

Possible Extensions

- Cross-region generalization (different rural landscapes)
- Perception-aware modeling (user preferences, cognitive styles)
- Crowdsourcing integration (collect missing attributes)
- Temporal dynamics (seasonal or time-dependent landmarks)

Research Questions

- Can machine learning predict which geographic features are perceived as landmarks in non-urban environments?
- Which features (semantic, visual, structural) contribute most?
- How does machine learning compare to existing rule-based models?
- How does data quality and completeness affect performance?

Methodology

- Data Collection
  - Extract features from OpenStreetMap and other geographic sources
  - Label landmarks using surveys or existing data
  - Assign dimensions and attribute values
    - Visual attributes
    - Semantic attributes
    - Structural attributes
- Modeling Approaches
  - Basis: Decision Trees
  - Advanced: Random Forest
  - Optional: Neural Networks….
- Evaluation
  - Accuracy, Precision, Recall, F1-score
  - Compare Machine Learning vs rule-based models

Tools

- GIS: QGIS / ArcGIS
- Python: GeoPandas, Scikit-learn
- Visualization: Web maps

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Marktplatz der Forschung