

GeoAI Elective Assignment 2026

Assignment Brief

Each student will undertake a discipline-specific GeoAI research project and progressively convert the work into a conference paper. The final submission must demonstrate a clear research problem, reproducible spatial-data workflow, appropriate GeoAI modelling, spatially aware validation, explainability, and planning/design/policy interpretation.

Objectives of the Assignment

- Identify a researchable spatial problem in architecture, transport, environmental planning, urban planning, regional planning, or heritage conservation.
- Build a reproducible spatial-data preparation and feature-engineering workflow using GIS, KNIME, Python, or a documented KNIME-Python hybrid workflow.
- Implement and compare at least one baseline model and one advanced GeoAI model appropriate to the research question.
- Use suitable predictive and spatial validation, error analysis, uncertainty assessment, and explainability methods.
- Translate model outputs into meaningful design, planning, management, or policy implications.
- Prepare and defend a conference-paper-format manuscript supported by original maps, figures, tables, and reproducibility material.

Permissible Research Domains and Indicative Themes

Domain	Indicative Themes
Architecture and Built Environment	Building energy/thermal/daylight prediction; typology classification; facility location; public-space performance; design evaluation, site analysis, structural analysis
Transport Planning	Traffic speed or ridership forecasting; crash-risk modelling; route choice and accessibility; public-transport/street-network analysis.
Environmental Planning and Management	Air quality, heat, noise or environmental exposure forecasting; flood/waste/ecological risk; environmental justice and spatial equity.
Urban Planning	Compact-city structure; polycentricity; mixed-use development; walkability/liveability; service accessibility; redevelopment potential; infrastructure demand.
Regional Planning	Regional interaction, migration and commuting; growth suitability; infrastructure priorities; regional disparities and resilience.

Domain	Indicative Themes
Heritage Conservation and Management	Heritage-building vulnerability; historic urban landscape analysis; cultural-route networks; adaptive reuse and conservation-priority decision support, crack detections
Environment Planning	Disaster tweet classification, heat vulnerability, flood predictions, Urban Heat Island classification

Assignment Development Stages

Stage 1 - Research Problem and Proposal: Define the problem statement, study area, research gap, objectives/research questions or hypotheses, conceptual framework, and preliminary data sources.

Stage 2 - Spatial Dataset and Exploratory Analysis: Prepare the spatial dataset; document sources and data dictionary; perform cleaning, spatial joins, feature construction, visualization, and exploratory spatial analysis.

Stage 3 - Baseline Model: Develop at least one appropriate baseline regression, classification, clustering, probabilistic, or other model. Document preprocessing, training strategy, parameters, metrics, and limitations.

Stage 4 - Advanced GeoAI Model: Develop at least one advanced model selected from the course, such as ensemble learning, ANN/CNN, RNN/LSTM/GRU, Bayesian Network, or GNN, depending on the research problem and data.

Stage 5 - Validation, Explainability and Interpretation: Compare models using suitable non-spatial and spatial validation. Include error analysis, uncertainty assessment, feature importance/SHAP or other explainability methods, and spatial interpretation using maps and charts.

Stage 6 - Conference Paper Conversion: Convert the complete project into a structured conference manuscript with a coherent research narrative, original results, reproducibility documentation, and clear design/planning/policy implications.

Required Conference Paper Structure

The final manuscript should be approximately 5,000-7,000 words and should follow the template of an appropriate peer-reviewed conference. Until a specific conference template is assigned, use the following structure:

Paper Section	Minimum Expectation
Title	Concise and research-focused; clearly indicate the GeoAI problem, method and/or study context.
Abstract (200-250 words)	Problem, data, method, key findings and contribution.
Keywords (4-6)	Include GeoAI method, spatial domain and major application terms.

Paper Section	Minimum Expectation
1. Introduction	Background, problem context, motivation, research gap, aim/objectives, research questions/hypotheses, and contribution.
2. Literature Review	Focused synthesis of relevant GeoAI/spatial-analysis literature leading to a clearly stated gap.
3. Study Area and Data	Study context, datasets, sources, spatial/temporal resolution, variables, data dictionary and ethical/privacy considerations where relevant.
4. Methodology	Reproducible preprocessing pipeline, feature engineering, baseline model, advanced model, workflow architecture, validation design, evaluation metrics, explainability and uncertainty methods.
5. Results	Model performance, comparison, spatial outputs, maps, figures, tables, error patterns and explainability results.
6. Discussion	Interpret findings in relation to the research questions and literature; discuss transferability, limitations, spatial bias, uncertainty and practical implications.
7. Planning / Design / Policy Implications	Translate the GeoAI findings into actionable recommendations, decision-support outputs or scenarios.
8. Conclusion	Summarize contribution, major findings, limitations and future research.
References	Use one consistent citation style and include only sources cited in the manuscript.
Reproducibility Statement / Supplementary Material	Identify software, workflow, data availability, code/notebook/KNIME workflow, model files and any access restrictions.

Final Submission Package

- Conference-paper-format manuscript (approximately 5,000-7,000 words).
- Reproducible KNIME workflow, Python notebook/scripts, or documented hybrid KNIME-Python workflow.
- Dataset or documented data-access procedure, together with a data dictionary and preprocessing notes.
- Original analytical maps, figures and tables used in the paper.
- Model evaluation outputs, including appropriate validation, error analysis and explainability/uncertainty evidence.
- A compact reproducibility package containing essential workflow/model files and a short README.
- 10-12 minute oral presentation. Video recorded presentation to be uploaded on the portal.

Evaluation Alignment with the Elective

The conference-paper assignment is designed to consolidate the project-related assessment components already defined in the elective framework. The relevant components are:

Component	What will be assessed	Marks in elective
Research proposal and literature review	Research gap, question, objectives, framework and sources	20
Methodology and reproducible workflow review	Data, preprocessing, baseline model, advanced model and validation plan	40
Conference-paper-equivalent final project and submission for conference	Manuscript, results, maps, interpretation and reproducibility package	20
Final Presentation	Research communication	20

Minimum Quality Requirements

- The paper must address a clearly defined research gap rather than only demonstrate software or a model.
- The methodology must be reproducible and sufficiently documented for another researcher to repeat the analysis.
- At least one baseline and one advanced model must be justified and compared.
- Validation must be appropriate to spatial data; where relevant, spatial cross-validation, blocked validation or leave-location-out testing should be considered.
- Figures and maps must be original, legible, captioned and directly discussed in the text.
- Results must include interpretation and implications, not only accuracy values.
- All external datasets, software, libraries, APIs and literature must be properly acknowledged and cited.
- Individual contribution must be documented for approved two-student teams.

Timelines

- Submission of topic August 19, 2026. Link for submission: https://docs.google.com/spreadsheets/d/1BaOpMXAypAfYdw_UWQWOkmbfOWfP5NXxAWOOUcDbTul/edit?usp=sharing
- Preliminary KNIME workflow/Python model submission September 9, 2026
- Final Model submission October 14, 2026
- Final Submission November 11, 2026