**Spatchat.org: An AI-powered Natural Language Platform for Spatial Intelligence and Ecological Modeling**

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**Abstract**

Spatchat.org is an open, extensible platform for conversational spatial analysis, powered by artificial intelligence and large language models (LLMs). Designed as a community-driven ecosystem, it enables researchers, educators, and practitioners to develop and share modular chatbot interfaces for spatial and landscape ecological modeling. Spatchat represents a paradigm shift in how we interact with spatial data, democratizing access to complex geospatial tools through natural language. This paper introduces the vision, architecture, and implications of Spatchat, highlighting its potential to unify diverse tools and workflows – ranging from Java- and Python-based models to R, ArcGIS, GRASS GIS, and more – under a shared, intelligent conversational interface. At its core, Spatchat exemplifies the transformative potential of human-AI interaction in spatial analysis.

**Introduction**

The geospatial sciences have long relied on sophisticated, often fragmented toolchains: GRASS GIS, ArcGIS, R-based packages like terra and landscapemetrics, and Python-based libraries like PyLandStats or GDAL. While powerful, these systems demand steep learning curves, hundreds of lines of custom code, and mastery of the functions and syntax spanning multiple software platforms and languages. For students and professionals alike, the technical overhead often becomes a barrier to insight.

As someone who has taught spatial ecology and modeling at the university level for many years, I have seen firsthand how students can thrive with spatial tools, and have celebrated with them in those moments of success. Yet, I have also seen how the steep learning curve can frustrate and hinder progress. While many eventually succeed, many others struggle with installing and integrating packages, understanding function parameters, and stitching together pipelines in unfamiliar programming environments. Spatchat emerges from this experience: a response to both the potential and pain points of current tools.

In an era of AI democratization, where large language models (LLMs) can interpret, generate, and reason about code and spatial theory, Spatchat proposes a unified conversational front end to streamline spatial workflows.

**Spatchat: Vision and Philosophy**

Spatchat.org is more than a tool. It is a platform. The Fragstats/PyLandStats assistant currently under development is only the first of many modular apps that will live under the Spatchat umbrella. Envisioned as the "ChatGPT for spatial modeling," Spatchat enables:

* **Natural Language Interfaces for Spatial Tools** – Users can interact with spatial models using plain English, asking questions like “Compare class 1 and 2,” “Run a connectivity analysis,” or “What is Shannon diversity?”
* **LLM-Powered Reasoning and Translation** – Under the hood, Spatchat uses LLMs to parse intent, translate queries into code, execute models, and return insights with explanations, visualizations, and summaries.
* **Developer Ecosystem** – Anyone can contribute their own chat-based models or analyses, such as species distribution models (SDMs), connectivity modeling, landscape resistance mapping, movement simulations, remote sensing processing pipelines. The possibilities are limitless and extend to any domain involving spatial modeling.
* **Cross-Platform and Language Support** – Whether your spatial engine is written in Python, R, Java, or called via REST APIs, Spatchat can wrap them into a universal friendly interface.
* **Cloud-Native and Real-Time Interaction** – Designed to be hosted in the cloud, Spatchat enables users to run complex models and receive responses instantly without local setup.

**Architecture**

Each Spatchat module comprises:

* A conversational logic layer (built using tools like Gradio, Langchain, or FastAPI)
* A spatial engine (e.g., PyLandStats, Circuitscape, MaxEnt)
* An intent parser and dispatcher (powered by LLMs like DeepSeek or OpenAI)
* Optional memory or project workspace integration for longer interactions

The frontend remains consistent: a lightweight chat UI, optionally embedded in notebooks, web apps, or third-party software.

**Demonstration: Spatchat for Landscape Metrics**

The first Spatchat implementation wraps PyLandStats to offer landscape metrics in a conversational format. Users upload a GeoTIFF land cover map and ask questions like:

* "Define edge density"
* "Compare patch density between class 1 and 3"
* "Calculate Shannon evenness index"

Spatchat interprets the intent, runs appropriate PyLandStats methods, and presents answers with clear, structured outputs. Variants (mean, SD, AW mean) and class-specific queries are automatically handled through dynamic prompting.

**Discussion: Toward a Conversational Spatial Stack**

Spatchat suggests a future where spatial modeling is not bound to syntax, but liberated through semantics. Analysts no longer need to memorize obscure function calls. They can reason through problems naturally, guided by AI-powered assistants that understand both ecology and computation.

This approach also holds promise for:

* Teaching spatial ecology interactively
* Creating reproducible, transparent workflows
* Bridging disciplines by lowering barriers to entry
* Community-driven expansion of analytical capabilities

Spatchat envisions the hosting of a wide range of spatial modeling bots, each tailored to specific analytical workflows. It eliminates the overhead of building from scratch and consolidates interfaces under a single, intuitive medium.

**Conclusion**

Spatchat.org lays the groundwork for a new generation of AI-powered spatial tools. What PyTorch did for deep learning, Spatchat may do for geospatial analysis: simplify the interface, modularize the logic, and open the door to a wider community.

By drastically reducing technical barriers, **Spatchat also** **opens the door to spatial analysis for much younger learners**. Its natural language interface enables exposure to landscape ecology and spatial reasoning even at the middle or high school level – long before students would traditionally encounter GIS or coding. By replacing hundreds of lines of code and eliminating the need to master the functions of countless packages across multiple languages, Spatchat creates an environment where ideas can take center stage, not syntax.

We invite collaborators to join us in building the future of spatial intelligence – one conversation at a time.

Ho Yi needs help with creating a simple website.

* Link that people click on and then SpatChat pops up in the browser
* Info page
* About us

We can reach younger audience

In the future – Recommendations based on results, spatial prioritizations