

Welcome to **instats**

The Session Will Begin Shortly

START

Using and Evaluating LLMs in Academic Work

Session 1: Factual Accuracy, Responsibility, and the Limits of Fluency

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instats Seminar

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Session 1: Factual Accuracy, Responsibility, and the Limits of Fluency

- 1 Challenges of LLMs in Scholarly Practices
- 2 Factual Accuracy, the Allure of Fluency, and Hallucinations
- 3 Governance and Validation

The LLM Revolution in Academia

- LLMs are becoming everyday collaborators in academic life.
- They assist in tasks ranging from:
 - Drafting manuscripts and literature summaries.
 - Designing syllabi and educational materials.
 - Supporting student supervision and feedback.

Technical vs. Epistemic Questions

- Adoption raises technical questions (efficiency, speed).
- More importantly, it raises fundamental epistemic and ethical questions.
- Key concern: Responsibility to preserve scholarly reliability and fair attribution.

Responsibility of the User

- The responsibility for verification rests squarely with the human user.
- Using an LLM does not absolve a researcher of responsibility; it heightens it.
- Researchers must verify all outputs.

Limitations of Current Discourse

- Current focus is often on preventing plagiarism and fact-checking.
- This focus on "local accuracy" is necessary but insufficient.
- It fails to address deeper systemic challenges to scholarly communication.

Beyond Isolated Errors

- The most significant risks are not simple factual mistakes.
- Risks involve systemic, structural distortions of knowledge.
- These distortions can misrepresent the entire landscape of a field.

The Primacy of Factual Accuracy

- Factual accuracy is a foundational moral requirement in academia.
- It is not optional or negotiable.
- No level of productivity justifies the introduction of error into the record.

The Mirage of Fluency

- LLMs generate highly fluent and stylistically appropriate text.
- This "polish" can mask underlying inaccuracies.
- It leads to a false sense of confidence in the model's reliability.

How LLMs Function: Probabilistic Prediction

- LLMs are designed to generate plausible sequences of text.
- They are NOT retrieval systems for verified facts.
- They predict the next token based on statistical patterns.

Defining Hallucinations

- Statements that are entirely fabricated but presented with confidence.
- They arise from the model's goal of maintaining surface-level plausibility.
- These errors are often indistinguishable from truth without domain expertise.

Synthesis vs. Accumulation

- Academic work is more than just a list of facts.
- It requires organization, interpretation, and synthesis.
- LLMs can fail at this global level while succeeding at a local level.

Local vs. Global Integrity

- **Local Accuracy:** Are the individual sentences true?
- **Global Integrity:** Is the overall structure of the field represented correctly?
- Distorting relationships between concepts is a failure of global integrity.

Intro to Structural Hallucination

- Distorts the relational structure of knowledge.
- Misrepresents bibliographic landscapes.
- Undermines intellectual attribution.

Conceptual Re-centering

- Assigning disproportionate importance to peripheral concepts.
- Marginal ideas are presented as foundational.
- This reshapes the perceived "core" of the intellectual field.

Accountable Research Partnership

A Necessary Paradigm Shift

- Move from "Uncontrolled Artificial Generators".
- Transition to an "Accountable Research Partnership".
- Governance must be proactive rather than reactive.

The Danger of Uncontrolled Generators

- Systems that produce text without user-side validation.
- Lacks checks for structural or bibliographic coherence.
- Leads to the spread of "polished" misinformation.

The Accountable Partnership

- A collaborative process between human and machine.
- Human actively governs LLM contributions.
- Use of explicit methodological and evaluative protocols.

Academic Inquiry Values

- The partnership is grounded in intellectual honesty.
- Requires rigorous argumentation.
- Committed to a shared, verifiable body of knowledge.

The Governance Framework

- Researcher- and instructor-centric.
- Suite of lightweight computational protocols.
- Individually implementable (not just for AI specialists).

The Multi-layered Validation Pipeline

- Translates text into structured representations.
- Quantitative comparison against trusted sources.
- Ensures structural and bibliographic integrity.

Epistemic Responsibility

- The framework is not meant to replace human judgment.
- It is a set of instruments to discipline human responsibility.
- Focus is on governance, not just performance optimization.

Application in Research

- Validating literature reviews and conceptual frameworks.
- Ensuring intellectual lineages are correctly positioned.
- Shifting from textual polish to epistemic alignment.

Application in Teaching

- Assessing if foundational works are emphasized in curricula.
- Detecting thematic gaps in LLM-generated syllabi.
- Maintaining expert control over curricular integrity.

Application in Student Assessment

- Distinguishing engagement from hollow reproduction.
- Using "validation reports" as assessment tools.
- Moving beyond crude detection to assessing critical use.

Summary: The Governance Shift

Reactive (Old)	Proactive (New)
Fact-checking	Structural Validation
Plagiarism detection	Attribution Integrity
Outright prohibition	Methodological Governance

Role of Network Science

- Uses established techniques from network science.
- Provides transparent, quantitative toolkits.
- Makes relational structures explicit and inspectable.

Bibliometric Foundations

- Grounding LLM outputs in real scholarly ecosystems.
- Comparing generated content to bibliometric baselines.
- Ensuring thematic coherence through data.

Reaffirming Academic Values

- Accountability is normative, not just technical.
- Requires a willingness to engage critically with new tools.
- Governance enables trustworthy scholarly contributions.

Session 1 Summary

- LLMs are powerful tools for academic work, but they also pose significant challenges.
- The most critical challenge is not factual error, but **structural hallucination**.
- We need to move from a model of uncontrolled generation to one of an **accountable research partnership**.
- This requires a proactive approach to methodological governance, based on a multi-layered validation pipeline.

Seminar Roadmap

Across sessions we will:

- ① Looking Ahead to Session 2: **Diagnose structural hallucination**
 - Deep dive into structural hallucination.
 - We will explore failure modes in detail.
 - Understanding the complex, hierarchical nature of academic knowledge.
- ② Translate text into networks
- ③ Apply network diagnostics
- ④ Validate citation integrity
- ⑤ Reframe attribution and assessment

Questions and Discussion

Thank you!

Questions?

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