

Yuchen Miao

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Education

Northeastern University | Sydney Smart Technology College

2023 - 2027 (Expected)

B.Eng. in Communication Engineering (joint program)

GPA: 3.8953/5.0 | Average: 88.9/100 | IELTS: 7.0

Research Interests

LLM Agents & Retrieval-Augmented Reasoning | Trustworthy Multimodal AI | Recommender Systems

Publications & Research Outputs

Peer-Reviewed / Accepted

- [1] **Yuchen Miao**, Zijun Wang, Chang Han, Yurui Shi, Mingtai Zhang, and Siyang Xu. “The ‘10th Juror’: Open-Set Standpoint Screening for Bureaucratic Bias Detection.” EMNLP 2026 (Main Conference) [ICORE A*; CCF-B].
- [2] **Yuchen Miao**, Zijun Wang, Ke Liu, and Siyang Xu. “Anatomy of a Decision: Uncertainty-aware Hierarchical Intent Learning via Flow Matching for Multimodal Recommendation.” WISE 2026 [ICORE B; CCF-B].
- [3] **Yuchen Miao**, Zijun Wang, Ke Liu, Peixuan Wang, and Chang Han. “IMEX-FND: A Traceable Interaction-Aware Mixture-of-Experts Framework for Multimodal Fake News Detection.” WISE 2026 [ICORE B; CCF-B].
- [4] **Yuchen Miao**, Mingxuan Cui, Yitong Zhu, Yu Wang, and Siyang Xu. “R3-REC: Reasoning-Driven Recommendation via Retrieval-Augmented LLMs over Multi-Granular Interest Signals.” ICASSP 2026 [CCF-B].
- [5] Yurui Shi*, **Yuchen Miao***, Ximing Hu, Zijun Wang, and Chang Han. “MOTIF: Motivation-guided Topology Inference for Cold-start Multimodal Recommendation.” WISE 2026 [ICORE B; CCF-B]. *Equal contribution.

Preprints & Manuscripts Under Review

- [6] **Yuchen Miao**. “Universal Refinement without Interaction: Order-Optimal 1-Bit Mean Estimation.” arXiv:2607.24358, 2026.
- [7] Zijun Wang, **Yuchen Miao**, Yifan Hu, and Huanmin Liu. “Sharp Root Anti-Concentration via Projective Incidence and Ordered Root Laws.” arXiv:2608.01670, 2026.
- [8] “Evidence-Trace Reasoning for Multimodal Misinformation Analysis.” First author; under double-blind review, 2026.
- [9] “Tool-Assisted Evidence Verification for Automated Manuscript Review.” First author; under double-blind review, 2026.

Patent

Yuchen Miao, Yu Wang, Gang Wang, Xin Feng, Siyang Xu. “Explainable Multi-Domain Mixture-of-Experts Method for Multimodal Fake-Content Detection.” Chinese Invention Patent Application No. 202511816918.8; filed Dec. 4, 2025; in substantive examination.

Research Experience

Hebei Key Laboratory of Marine Perception Network and Data Processing | Undergraduate Researcher 2025 - Present

- Research on interpretable multimodal recommendation, misinformation detection, LLM agents, and trustworthy AI, using RAG, graph learning, flow matching, mixture-of-experts, and contrastive learning.
- Work across the full research cycle: literature review and reproduction, failure analysis, problem formulation, method design, experiments and ablations, paper writing, and rebuttal.

Interpretable Recommendation and Fake-Content Detection for New Media Security | National Innovation Program 2025 - Present

- National College Students’ Innovation and Entrepreneurship Training Program, Project No. 202619145026; work on retrieval-augmented recommendation and multimodal misinformation detection led to R3-REC (ICASSP 2026) and IMEX-FND (WISE 2026).

Evidence-Grounded AI for Bias and Misinformation

- **MARS-Gov**: Traced a recurring failure to the closed-world assumption of nine fixed bias categories and proposed a dynamic Scout-Juror mechanism that can surface previously undefined affected groups.
- Built three-stage retrieval (keyword, semantic, and local-context reading), then coordinated Scout, fixed and dynamic Jurors, a Judge, and a Restoration agent for legal/policy evidence checking and meaning-preserving rewriting. Reached F1 = 0.880 on DGDB, 20.2 points above the strongest zero-shot LLM; leave-one-category-out evaluation achieved Correct@1 = 85.1% and Correct@3 = 93.8%.
- **IMEX-FND**: Designed sample-level routing over text, image, and fusion streams, followed by five interaction experts for text-unique, image-unique, fusion-unique, synergistic, and redundant evidence.
- Used modality-replacement constraints to keep the interaction experts differentiated while exposing inspectable routing and interaction weights. Removing routing reduced Macro-F1 by about 3.1 points on cases where the text- and image-only predictions disagreed.

FalsiTrace / GAVEL | Verifiable Multimodal Fact Verification

- Curated 30,706 news records from 2018-2026, including 23,090 text-image instances, with four groups and thirteen attribution types; annotated the central false claim, corrected facts, decisive evidence, and reference debunking path.
- Built GAVEL to decompose claims, run text, cross-modal, visual-forensics, and framing checks, retrieve external evidence only when needed, and localize decisive cues. It reached Macro-F1 = 93.41, Type-R = 90.48, and 87.92% joint verdict-trace success versus 78.96% for the strongest baseline.

LLM-Enhanced Recommender Systems

- **UHIFlow:** Used conditional flow matching to quantify visual and textual uncertainty and let it set each user’s intent-hierarchy depth, backing uncertain users off to coarse intents; improved every reported metric by 2.81%-3.04% over the strongest baseline across three datasets.
- **R3-REC:** Found prompt-level overfitting while reproducing PO4ISR, then reframed ranking around structured evidence from multi-granular intents, preference polarity, compact item keyphrases, and BM25/Sentence-BERT similar-user retrieval. HR@1 improved by 9.9% on Games and 10.2% on Bundle, with approximately 580 ms latency.
- **MOTIF:** Co-developed an offline LLM pipeline that turns inferred motivations into reconstructed item topology for cold-start graph learning; reduced the isolated cold-item ratio from 0.412 to 0.017 and improved Recall/NDCG by up to 6.07%, while online inference remained graph-only.

Evidence-Driven LLM Agents

- **ECDTRP:** Built a contribution-first review agent that stabilizes a paper’s claimed contribution before judging it, plans venue- and rubric-specific checks, and calls literature, web, repository, full-text, figure, and formula tools only when needed.
- Stored high-value evidence in a selective review memory and bound each critique to its source, review dimension, and confidence before calibrated fusion. On ICLR-OR-BENCH, reached 61.23% three-way accuracy (+10.5 points over GPT-4o + RAG) and cut wrong citations from 22.1% to 6.3%.

Other Selected Research

- **Universal Refinement without Interaction:** Addressed a COLT 2026 open problem with fully non-adaptive one-bit queries, decoder-side refinement, safe periodic residues, and an adjacent-scale telescope, attaining the same order-optimal sample complexity as adaptive protocols.
- **Sharp Root Anti-Concentration (2nd author):** Derived dimension-free local anti-concentration bounds via projective incidence and ordered-root laws, with regret implications for graph learning.
- **FOREST (4th author):** Designed rule-bound boundary memory and a validation gate for rule-based LLM moderation; Macro-F1 improved by 9.62 points on WaterArmy and 6.89 on Reddit.
- **SPARE-LoRA (6th author):** Developed replay-free continual learning for LLMs with shared-basis rank experts, load calibration, and representation distillation; TRACE = 56.6 and BWT = -3.1.

Industry Experience

Shanxi Branch of China Development Bank Information Technology Intern	Jul 2025 - Aug 2025
Supported information-system operations/testing, network security, and video-system administration.	
Huajin Coking Coal Co., Ltd. Big Data Center Intern	Jul 2024 - Sep 2024
Conducted data analysis/mining and assisted with the design and optimization of data-processing workflows.	
Beijing Codnoy Technology Co., Ltd. Engineering Intern	Jul 2024 - Oct 2024
Developed device drivers in C and performed hardware debugging; received the Outstanding Intern Award.	

Honors & Technical Skills

Honors:

- Finalist Award (Top 1%), The Mathematical Contest in Modeling (MCM), 2026;
- National Third Prize, The 18th Advanced Robot and Simulation Technology Competition, 2025;
- Northeastern University Third-Class Scholarship (5 times), 2023–2026;
- Provincial Second Prize, National College Students’ Market Research & Analysis Competition, 2025
- Second Prize, “Survey Hebei” Social Survey Activity for College Students in Hebei Province, 2025.

Programming & Tools: Python, PyTorch, C, MATLAB, LaTeX | **ML:** LLMs, RAG, multimodal learning, recommender systems, graph learning, flow matching, MoE, contrastive learning | **Systems:** data analysis/mining, experimental evaluation, embedded driver development, hardware debugging