Mohanna Hoveyda

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I am a third-year PhD candidate at Radboud University, specializing in *Conversational AI*. My research interests encompass: **1)** Developing reinforcement learning-based **orchestration** frameworks that adaptively select and configure building blocks (agents, tools, and models) in modular information access systems, based per user inputs, and **2)** Employing neuro-symbolic solutions for more reliable and efficient probabilistic **reasoning** with LLMs. Currently, I am looking for a *research* position in industry where I can leverage my experience to develop trustworthy, efficient, and adaptive information access systems.

EDUCATION

PhD, Radboud University, iCIS — Nijmegen, The Netherlands
Reasoning and Adaptive Orchestration in Non-Monolithic AI Systems
Feb 2023–Feb 2027 (anticipated)
Advisors: Arjen P. de Vries, Faegheh Hasibi, Maarten de Rijke
Research Group: Informagus

MSc, University of Tehran, FNST — Tehran, Iran
Computational Linguistics — *Sep 2020–Jan 2023*
Thesis: Network Science-Based Structural Analysis of Human- and Machine-Based Semantic Representations

Bachelor, University of Tehran, ECE & FFLL — Tehran, Iran
Computer Engineering (Minor) — *2018–2020*
French Language and Literature (Major) — *2016–2020*

RESEARCH

Reproducing Complex Set-Compositional IR — **SIGIR 2026**
Vincent Degenhart, Dewi Timman, Arjen P. de Vries, Faegheh Hasibi, Mohanna Hoveyda

- Initiated and supervised the project on benchmarking a wide range of retrieval models (e.g., lexical, dense, LSR, and reasoning-targeted methods) on set-compositional queries involving logical constraints such as negation and disjunction.
- Introduced LIMIT+, a benchmark revealing gains on existing complex-query benchmarks reflect semantic shortcuts rather than genuine constraint satisfaction.

OrLog: Resolving Complex Queries with LLMs and Probabilistic Logic Programming — **ECIR 2026**
Mohanna Hoveyda, Jelle Piepenbrock, Arjen P. de Vries, Maarten de Rijke, Faegheh Hasibi

- Built a neuro-symbolic retrieval framework that integrates *probabilistic priors from LLMs* with a *logic programming engine* to enforce query constraints (i.e., conjunction, disjunction, negation) in ranking.
- Achieved higher accuracy with ∼90% lower token cost compared to end-to-end LLM reasoning, demonstrating how smaller models can replace brute-force scaling for large-scale retrieval systems.

Adaptive Orchestration of Modular Generative Information Access Systems — **SIGIR 2025**
Mohanna Hoveyda, Harrie Oosterhuis, Arjen P. de Vries, Maarten de Rijke, Faegheh Hasibi

- Designed a modular GenIA architecture for real-time adaptive orchestration of *LLM agents*, retrieval models, and external tools per query to maximize performance while cutting computational overhead.
- Developed a dynamic QA system that adaptively selects optimal answering strategies based on question complexity under resource constraints, using *contextual*

multi-armed bandits.

Real-World Conversational Entity Linking Requires More Than Zero-Shots **ACL 2024**
Mohanna Hoveyda, Arjen P. de Vries, Maarten de Rijke, Faegheh Hasibi

- Built a Reddit-based conversational EL dataset to evaluate zero-shot models on unseen, domain-specific knowledge bases.
- Fine-tuned and evaluated BERT-based EL models, revealing severe accuracy drops on unseen knowledge bases.

Network Science-Based Structural Analysis of Heterogeneous Semantic Representations **Master's Thesis**
Mohanna Hoveyda, Paulino Villas-Boas, Mahmood Bijankhan, Mostafa Salehi

- Designed a statistical framework with configuration models and hypothesis testing for size-invariant comparison and clustering of non-isomorphic networks.
- Applied graph-theoretic metrics to compare semantic representations across machine-learned (uni-modal: Word2Vec, BERT; multi-modal: VisWord2Vec), human-curated (WordNet, ConceptNet), and hybrid (ConceptNet Numberbatch) spaces.

TUTORIALS

Reasoning for IR & IR for Reasoning **ECIR 2026, SIGIR 2026**
Mohanna Hoveyda, Panagiotis Eustratiadis, Arjen P. de Vries, Maarten de Rijke

- Designed a half-day tutorial on reasoning-capable information retrieval, covering logical constraints, multi-step inference, neuro-symbolic reasoning, probabilistic frameworks, geometric representations, and energy-based models and RL.
- Introduced an analytical framework for mapping reasoning methods and for identifying trade-offs, complementarities, and opportunities across IR, NLP, and the broader AI landscape for developing reasoning models.

EXPERIENCES

Visiting Researcher, KPN, The Netherlands September 2025 - Ongoing
Supervising MSc research interns on enhancing knowledge representation and on adaptive orchestration of agents and tools for more effective RAG.

Teaching Assistant
Information Retrieval (Radboud University)
Machine Learning for NLP (University of Tehran)

Supervision

Tsvetomira Krikoryan (MSc internship, Completed, Wintertuin Company):
Training a GPT-2 model on Papiamentu for creative task assistance

Luuk van den Hurk (MSc thesis, September 2025, KPN Company):
Enhancing Knowledge Representation for more effective RAG

Mario Tsatsev (MSc thesis, September 2025, Radboud University):
Enhanced prior probability estimation for neuro-symbolic reasoning in complex IR

Federico Signorelli (MSc internship, January 2026, University of Amsterdam & KPN):
Adaptive orchestration of agents and tools for more effective RAG

SKILLS & TOOLS

Python, C, C++
PyTorch, TensorFlow, Scikit-learn, Hugging Face
ElasticSearch, Lucene, Faiss
HPC, vLLM
Z3 SMT solver, ProbLog
NetworkX, Matplotlib, Seaborn

LANGUAGES

Persian (Native), *English* (Fluent), *French* (Intermediate), *Dutch* (Basic)

AWARDS & SCHOLARSHIPS

Ranked 6th in Computational Linguistics National Master's Entrance Exam, Iran National Organization for Educational Testing (2020)

Scholarship for Computational Linguistics Master's Program, University of Tehran, Iran (2020)

PRESENTATIONS

Reasoning for IR & IR for Reasoning. Tutorial, ECIR'26, Delft, The Netherlands.

Adaptive Orchestration of Agents, Tool Usage, and Reasoning in Information Access Systems. Oral presentation, DIR'25, Nijmegen, The Netherlands.

Designs of Future Information Access Systems Should Be Modular, Adaptive and Dynamic. Poster presentation, CONSEQUENCES @ RecSys'25, Prague, Czech Republic

Understanding Diverse Reasoning Procedures in Foundation Models via Mechanistic Interpretability. Poster presentation, Cognitive Computational Neuroscience Conference CCN'25, Amsterdam, The Netherlands.
Extended abstract co-authored with Jasmin Kareem, Roxana Petcu, Angela van Sprang, and Ana Lucic.

Adaptive Orchestration of Modular Generative Information Access Systems. Oral presentation, SIGIR'25, Padova, Italy.

Real-World Conversational Entity Linking Requires More Than Zero-Shots. Poster presentation, ACL'24, Bangkok, Thailand.

WORKSHOPS & SCHOOLS

European Summer School on Information Retrieval (ESSIR), University of Amsterdam, Netherlands (2024); Technische Universität Wien, Austria (2023)

High-Performance Computing (HPC) and Deep Learning Workshop, HPC Laboratory, IPM, Tehran, Iran (2022)

Summer School of Intelligent Learning, IPM & Sharif University of Technology, Tehran, Iran (2019)

Autumn School of Mind and Brain, Cognitive Sciences and Technologies Council & University of Tehran, Tehran, Iran (2018)

REFERENCES

Arjen P. de Vries `a.devries@cs.ru.nl`
Professor of Information Retrieval at Radboud University and Research Director of iCIS

Maarten de Rijke `m.derijke@uva.nl`
Professor of Artificial Intelligence and Information Retrieval at UvA