

COMPUTER AND CONTROL ENGINEERING

Eurecom/DAUIN - Enhancing Educational Storytelling with Human-Centered AI in the LLM Era

Funded By	Dipartimento DAUIN EURECOM - ECOLE D'INGENIEURS & CENTRE DE RECHERCHE EN SYSTEMES DE COMMUNICATIONS [P.iva/CF:65383181575]
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Context of the research activity	<p>The PhD aims to develop novel methods and techniques for allowing end-users to create interactive educational narratives from structured resources such as knowledge graphs. The research envisions combining generative models with Retrieval-Augmented Generation (RAG) and end-user personalization strategies, moving beyond simple binary-choice formats and thus enabling more engaging, custom-tailored, and culturally adaptive storytelling.</p>
	<p>Interactive storytelling holds significant potential for enhancing educational experiences by engaging learners through tailored, culturally adaptive narratives. Recent advancements highlight that educational storytelling, enriched by interactive personalization, increases learner motivation and deepens understanding and retention of content. Despite these benefits, educators often lack the technical skills necessary to create sophisticated interactive narratives, and current generative AI tools alone do not reliably produce culturally sensitive and accurate educational content without structured guidance.</p> <p>Knowledge graphs (KGs) provide a backbone of real-world entities and relations that can ground these stories in accurate information. By augmenting a system based on Large Language Models (LLMs) with retrieved facts or connections from a KG or similar sources, the system can dynamically incorporate relevant background information (e.g., historical events, definitions, examples) into the story, improving factual accuracy and depth. This approach builds on the Retrieval-Augmented Generation (RAG) paradigm, where external non-parametric memory is tapped to overcome the limited knowledge coverage of standalone LLMs. In an educational storytelling context, RAG allows the narrative to remain up-to-date and richly informative, drawing on sources like domain knowledge graphs or textbooks on demand.</p>

Objectives

Central to this approach is the integration of KGs as structured semantic backbones, ensuring factual correctness, educational relevance, and cultural adaptation in storytelling. For example, if the educator wants to set a biology lesson as a fantasy story, the metaphors and characters can be adjusted to ones familiar in the learner's culture (animals, folklore, historical figures, etc.). We propose employing RAG techniques – demonstrated effective in tasks demanding factual grounding – to dynamically retrieve contextually relevant educational resources from structured knowledge bases. Educators, via intuitive end-user development user interfaces inspired by recent research in end-user website generation and KG-based debugging of interactive trigger-action rules, will specify narrative constraints and themes, educational and pedagogical goals, and personalization strategies. The generative model, enriched by retrieved knowledge from structured educational graphs, will then produce interactive, culturally nuanced narratives tailored to individual learners. The research activity will build upon successful approaches to fine-tune large language models for educationally engaging dialogues and extend those toward fully interactive, branching, educational storylines.

This PhD proposal directly builds on the complementary expertise of Politecnico di Torino, with its extensive background in end-user AI empowerment, and EURECOM, known for its expertise in KG-driven narrative generation and advanced AI storytelling approaches. The PhD student will split their time equally between EURECOM and Politecnico di Torino, spending 1.5 years at each institution.

This research is expected to make significant contributions in both the Artificial Intelligence and Human-Computer Interaction fields by enabling the scalable creation of culturally aware, personalized educational stories while also strengthening scientific collaborations between the two institutions.

The results of this research are expected to be published in leading conferences on Artificial Intelligence, Human-Computer Interaction and Information Retrieval (e.g., ACM CHI, ACM IUI, UMAP, ACM TheWebConf, ECIR, CIKM). Additionally, one or more journal publications are anticipated in a subset of the following international journals: ACM Transactions on Interactive Intelligent Systems, ACM Transactions on the Web, and ACM Transactions on Information Systems.

Skills and competencies for the development of the activity

The ideal candidate should have a solid background in Computer Engineering or Data Science, with prior experience in AI, particularly in machine learning and/or deep learning.

Proven knowledge and experience with RAG, LLMs, and knowledge graphs is a plus.

Additionally, the candidate should have knowledge of Human-Computer Interaction methods and techniques, experience with user interface creation, and demonstrable proficiency in English.