# THE ABSTRACT OF DOCTORAL THESIS

## *I. Summary of the Introduction*

- Title: Robust and Adaptive Recommendation by Deep Modeling of Canonical and Auxiliary Data

## *II. Contents of the Abstract*

1. Research objectives and subjects of the dissertation

   The dissertation research aims at three main objectives:

   - **First**, developing a unified recommendation system framework based on Graph Neural Networks (GNNs) to address cold-start challenges, data sparsity, and scalability issues. This framework combines side information fusion techniques based on attention mechanisms, soft clustering, and masked contrastive learning to create fair, robust, and ID-independent user-item embeddings.
   - **Second**, proposing a continual learning framework based on task masking for multi-domain recommendation to ensure fair and unbiased performance across multiple domains and user segments, while preventing catastrophic forgetting and enabling sustainable multi-domain adaptation.
   - **Third**, building a hybrid recommendation framework that integrates graph-based deep learning with Large Language Models (LLMs) in a Retrieval-Augmented Generation (RAG) architecture, aiming to enhance movie recommendations by combining historical user-item interaction data with real-time conversational feedback to improve accuracy, personalization, and context awareness.

2. Research methods

   The dissertation uses a combined research approach including both qualitative and quantitative research methods. The dissertation conducts qualitative analysis of concepts and models from related literature on recommendation systems, Graph Neural Networks, contrastive learning, and continual learning. From this, new graph-based recommendation techniques and models are proposed.

   At the same time, the dissertation conducts quantitative research through implementing corresponding experimental systems on standard datasets such as MovieLens-1M, TV360, Book-Crossing, and Douban. Specific techniques used include: Graph Neural Networks for modeling user-item interactions; Self-supervised contrastive learning with masked graph learning; Continual learning with task masking to protect domain-specific knowledge; Attention-based fusion techniques for side information; and Retrieval-Augmented Generation combined with LLMs.

3. Main results and Conclusions

Participating in the global research stream on intelligent recommendation systems and graph-based learning, the dissertation has completed its research objectives with three main contributions:

- **First**, the dissertation proposes research on a unified GNN-based recommendation framework that solves cold-start, data sparsity, and large-scale scalability issues. Following this direction, the dissertation develops three models: EfficientRec using soft clustering and interaction embedding profiles to eliminate user ID dependency; Masked Simple Graph Contrastive Learning (MS-GCL) applying learnable masking mechanisms to improve representation quality; and GIFT4Rec integrating multi-source side information through attention mechanisms to solve cold-start problems.
- **Next**, the dissertation has researched and developed a continual learning framework for multi-domain recommendation. By synthesizing research on task masking and domain adaptation, the dissertation has proposed the CL4Rec model with two main components: Domain Masking to identify and protect important parameters for each domain, and Domain Specialization to prevent catastrophic forgetting. This framework is model-agnostic and can be applied to various latent models such as matrix factorization, graph neural networks, and auto-encoders.
- **Finally**, the dissertation researches conversational recommendation systems and develops a hybrid GNN-RAG-LLM architecture. Following this research direction, the dissertation integrates the structural power of GNNs in modeling user-item interactions with the contextual understanding capabilities of LLMs. The system includes two main components: a conversational generator to understand user intent and a recommendation generator to create personalized recommendations based on both historical data and real-time conversational feedback.

With the newly proposed models, the dissertation conducts comprehensive experiments and compares results with state-of-the-art models. Through experimental results on multiple standard datasets, the dissertation has shown the superior effectiveness of the proposed methods with significant improvements in accuracy (84% on HitRatio@20), computational performance (42-908 times faster), and scalability in real-world environments.

List of scientific publications related to the thesis:


1. "An incremental ensemble learning system for Vietnamese e-commerce product classification", (KSE 2021), The 13th IEEE International Conference on Knowledge and Systems Engineering
2. "EfficientRec: An unlimited user scale recommendation system based on clustering and user's interaction embedding profile", (ACIIDS – 2022), 14th Asian Conference on Intelligent Information and Database Systems
3. "GIFT4Rec: An effective side Information Fusion Technique apply to Graph neural network for cold-start recommendation", (ACIIDS – 2023), 15th Asian Conference on Intelligent Information and Database Systems, Pages 334 – 345
4. "The Masked Simple Graph Contrastive Learning for Recommendation" In 16th International Conference on Knowledge and System Engineering (KSE) (pp. 156-160). IEEE., 2024
5. "Continual Learning based on Task Masking for Multi-Domain Recommendation" In Asian Conference on Intelligent Information and Database Systems, 2024

6. “Summarizing Vietnamese Books Using a Multi-stage Hybrid Pipeline” In 17th International Conference on Computational Collective Intelligence, 2025
7. “Improving Retrieval-Augmented Generation for Scalable Movie Chatbots via Graph Based Recommendation Models” In – Submitted (In-peer-reviewing) – IEEE Access

*Hanoi,  /  /2026*