Cultivating Research Excellence in Artificial Intelligence: Strategies for Building and Sustaining a Research Group

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Hanoi University of Science and Technology

About me!

Research Interests

- Computational Intelligence
- Artificial Intelligence
- Optimization
- Evolutionary Multitasking

Editorial Boards

Associate Editor

- **Swarm and Evolutionary Computation**
  2024 – present
- **IEEE Transactions on Emerging Topics in Computational Intelligence (TETCI)**
  2022 – present
- **Engineering Applications of Artificial Intelligence (EAAI)**
  2022 – present

Professional Services

- **IEEE Region 10 Executive Committee**
  2026
- **Scientific Council for Computer Science, NAFOSTED**
  Chair 2025 – 2027 · Vice Chair 2023 – 2024
- **IEEE Vietnam Section**
  Chair

Outline

01 Research Groups in the Universities

02 Our Research Group

03 Research Topics

04 Awards and Achievements

Research Groups in the Universities

Research Group where the university's three missions meet

Research
Generate new knowledge

- Tackle frontier scientific problems
- Publish high-impact work
- Win competitive research grants

Education
Train people through research

- Bring research into teaching
- Supervise BSc, MSc and PhD students
- Develop future researchers and lecturers

Engagement
Link with industry and partners

- Collaborate with industry
- Build international partnerships
- Transfer knowledge and technology

Research Groups in the Universities
Contributions to the University

Talent
Attract and retain talented students and staff; grow the pipeline from students to PhDs and faculty

Knowledge
High-impact research and international publications on frontier challenges

Resources
Competitive funding from national, international and industry sources

Reputation
Greater international visibility, reputation and rankings

Research University

Better education and training

Stronger global standing

Strong research groups are the building blocks of a research university

Research Groups in Universities
Key Challenges



Human Resources
Attracting and retaining researchers



Funding
Securing stable, long-term investment

Our Research Group
Group Structure

Team Leader



Prof. Huynh Thi Thanh Binh

Postdocs &
PhD Alumni









PhD Students







Students



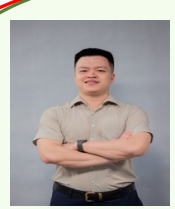
Our Research Group

Members Worldwide

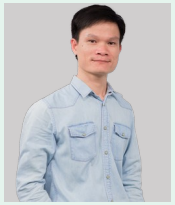


Our Research Group

Research Collaboration Network







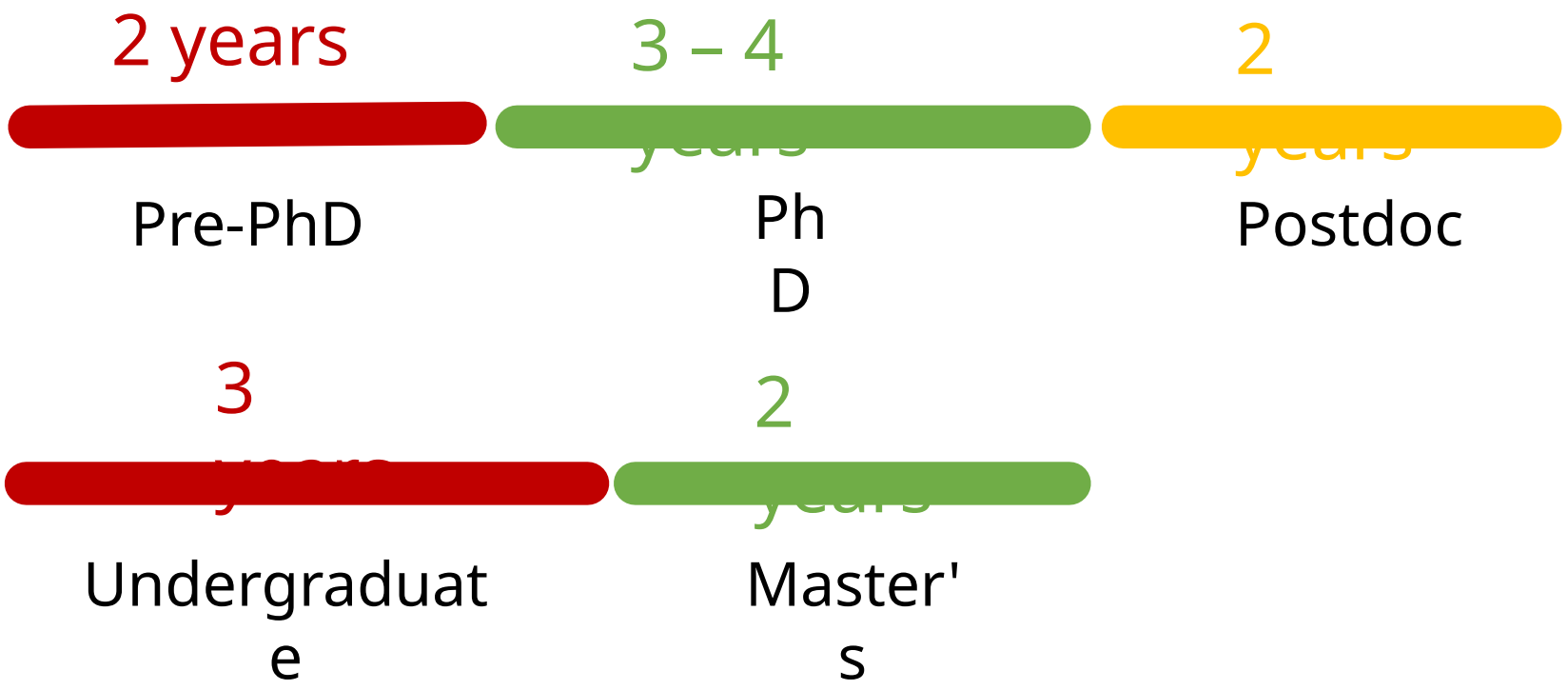







Our Team

Our Research Group
Talent Development Pathway



Our Research Group
Roles of Postdoctoral Researchers



Research



Teaching



Student Supervision

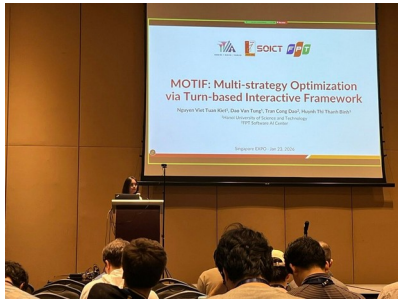
Our Research Group

International Conferences Participation





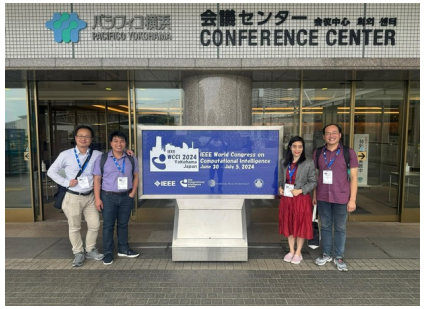










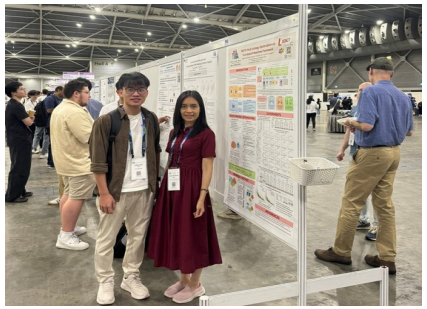










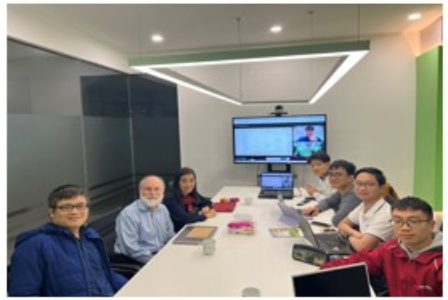






Our Research Group

Research Group Activities



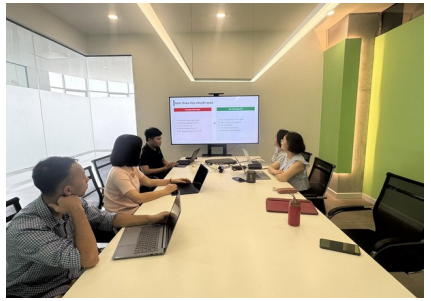






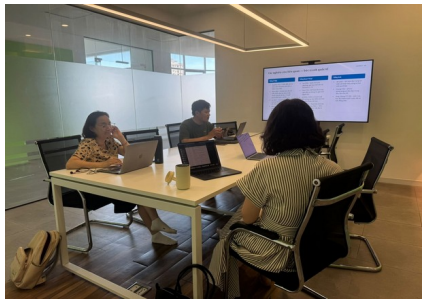












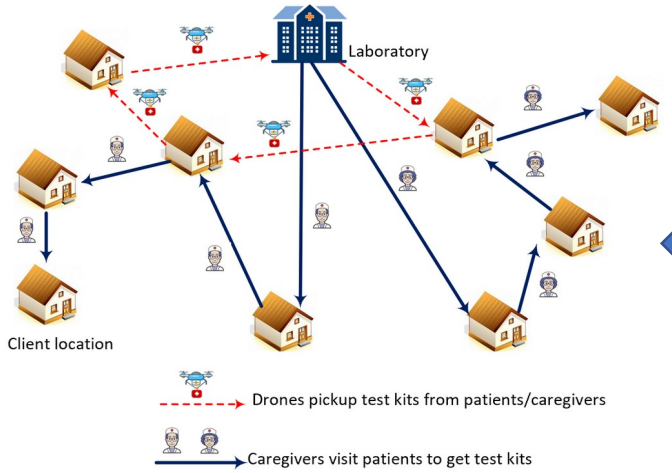

Research Topics

1. Enhanced Evolutionary Computation – Multitask & Multi-objective Optimization
2. Multi-objective & Multi-agent Reinforcement Learning
3. LLM for Optimization – Modelling & Automatic Heuristic Design
4. Optimization in Applications

Enhanced Evolutionary Computation – Multitask & Multi-objective Optimization

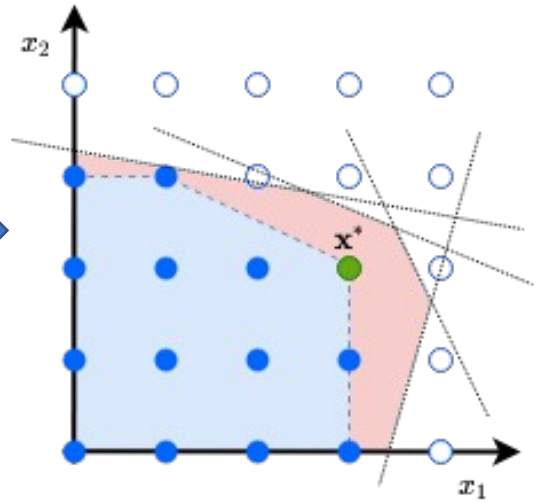
Enhanced Evolutionary Computation

Evolutionary Multitask Optimization

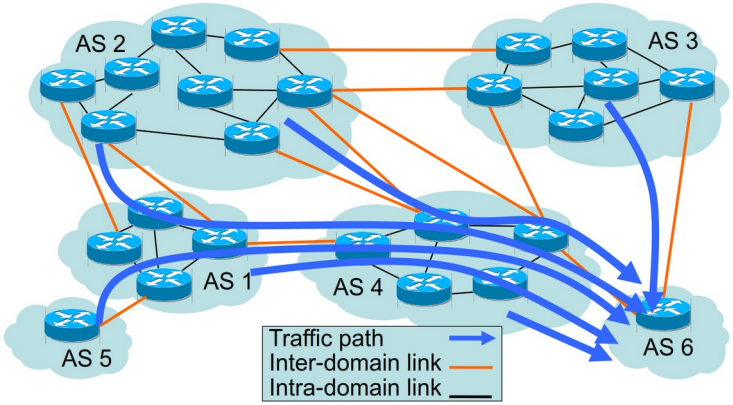


Path planning for drones

Mixed-Integer Programming problems

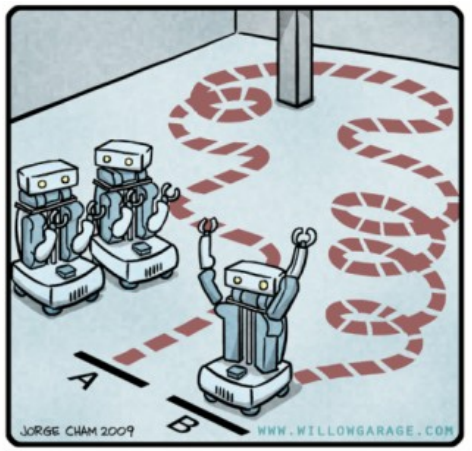


Optimizer



Network design

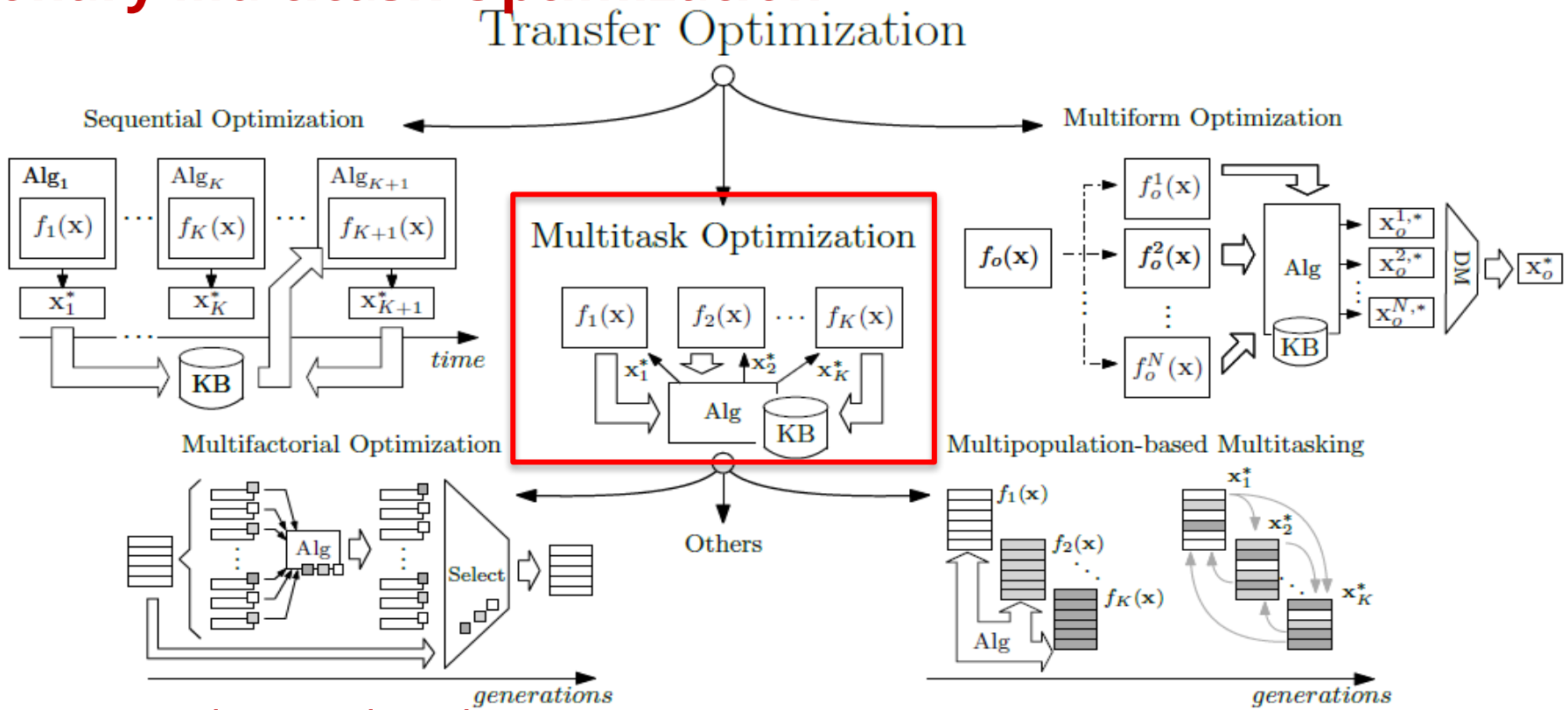
Path planning for robots



H. T. T. Binh et al., "Ensemble multifactorial evolution with biased skill-factor inheritance for many-task optimization", *IEEE Transactions on Evolutionary Computation*, 2022.

Enhanced Evolutionary Computation

Evolutionary Multitask Optimization



Implicit multitasking

- Unified representation
- Transfer knowledge by **crossover** on unified search space

Explicit multitasking

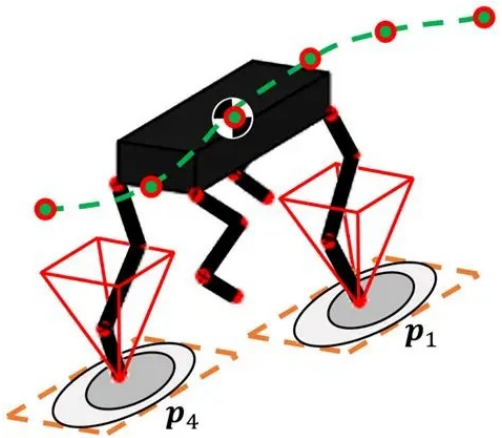
- Multi-population
- Transfer knowledge by **migration** from source tasks to other tasks

N. B. Long et al., "An online transfer learning based multifactorial evolutionary algorithm for solving the clustered Steiner tree problem", *Knowledge-Based Systems*, 2024.

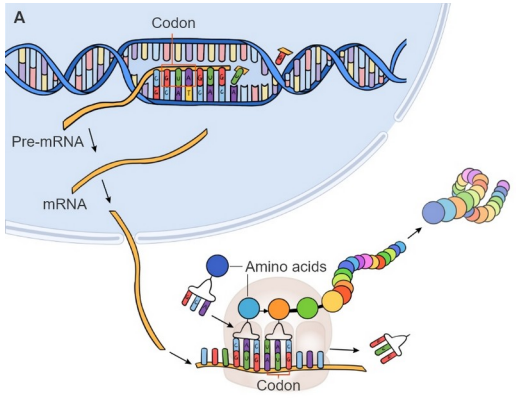
Enhanced Evolutionary Computation
Expensive Multi-objective Optimization

- Optimize multiple conflicting objectives under severely **limited evaluation budgets**

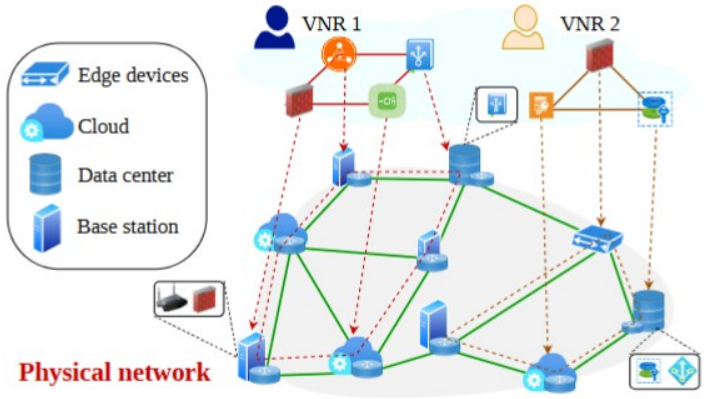
- Each objective evaluation may require costly computation or physical experimentation
- **Objective: Approximate the Pareto front**



Physical testing



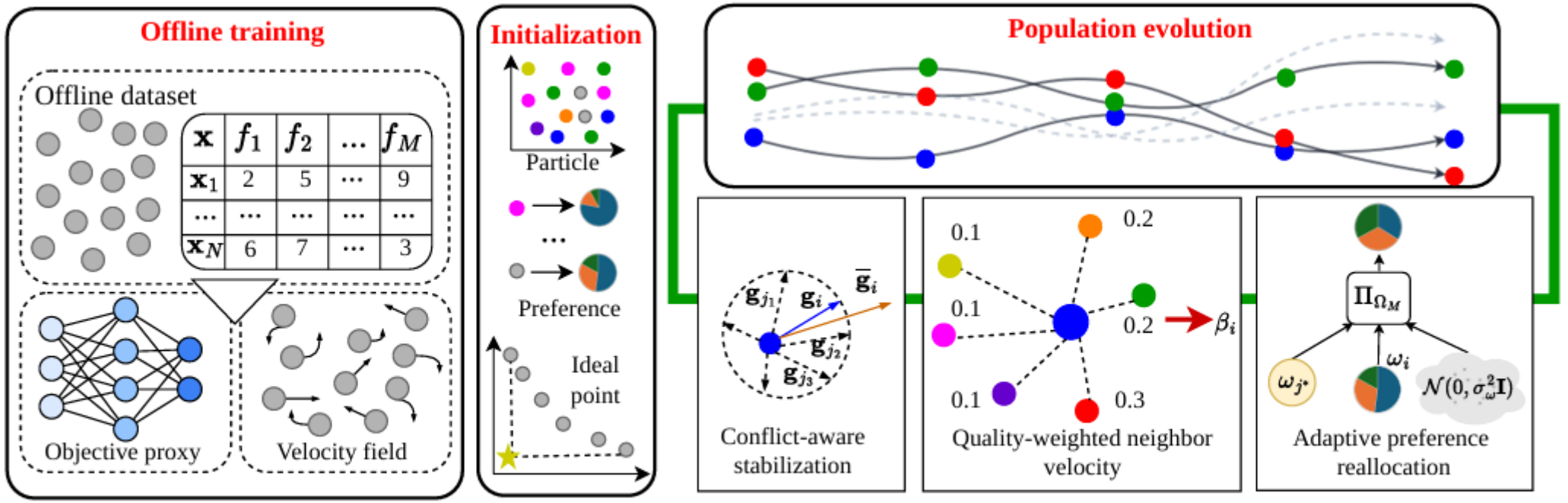
High-fidelity simulation



Real-world network

Enhanced Evolutionary Computation

Offline Multi-objective Optimization via Population Flow



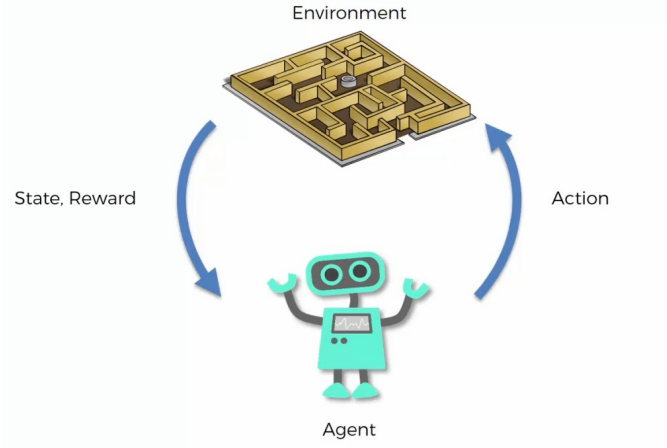
Overview of EvoFlow

H. M. Hieu et al., “Pareto-grid-guided large language models for fast and high-quality heuristics design in multi-objective combinatorial optimization”, *AAAI 2026*.

Multi-objective & Multi-agent Reinforcement Learning

Multi-objective Reinforcement Learning

Constrained MORL under Drifting Preferences & Budgets



Markov decision process

$\mathcal{M} = (\mathcal{S}, \mathcal{A}, P, \mathrm{r}, \gamma)$

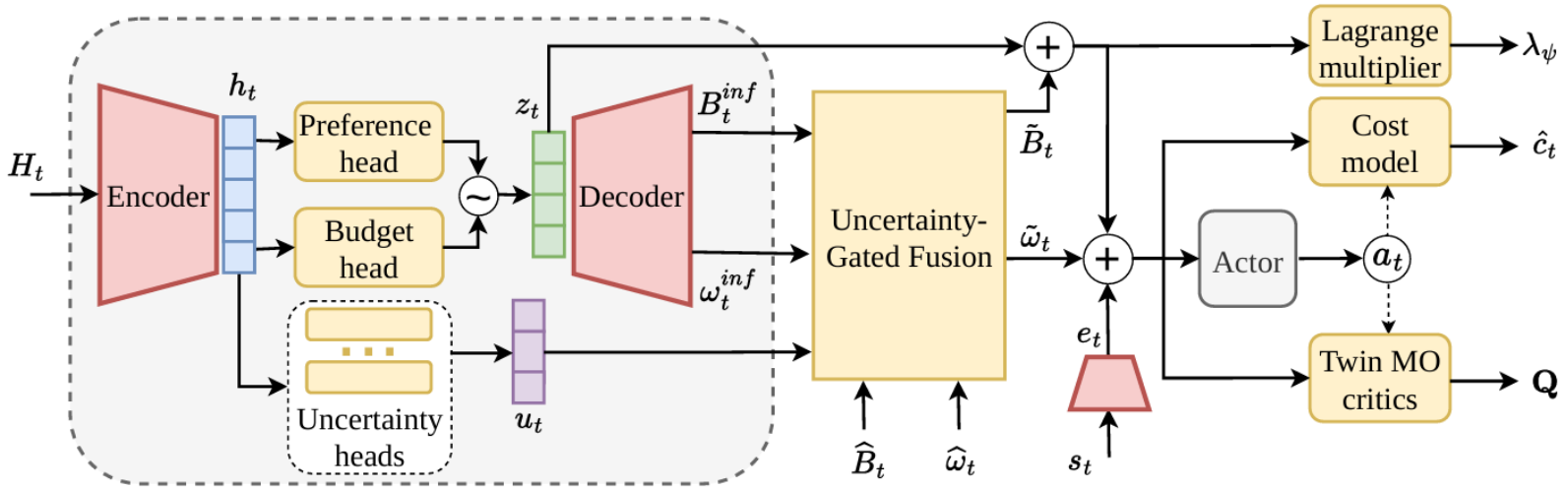
Multi-objective constrained Markov decision process

$\mathcal{M} = (\mathcal{S}, \mathcal{A}, P, \mathbf{r}, c, \gamma)$

$\mathbf{r}: \mathcal{S} \times \mathcal{A} \rightarrow \mathbb{R}^K$

$c(\boldsymbol{s}, \boldsymbol{a}) \geq \mathbf{0}$

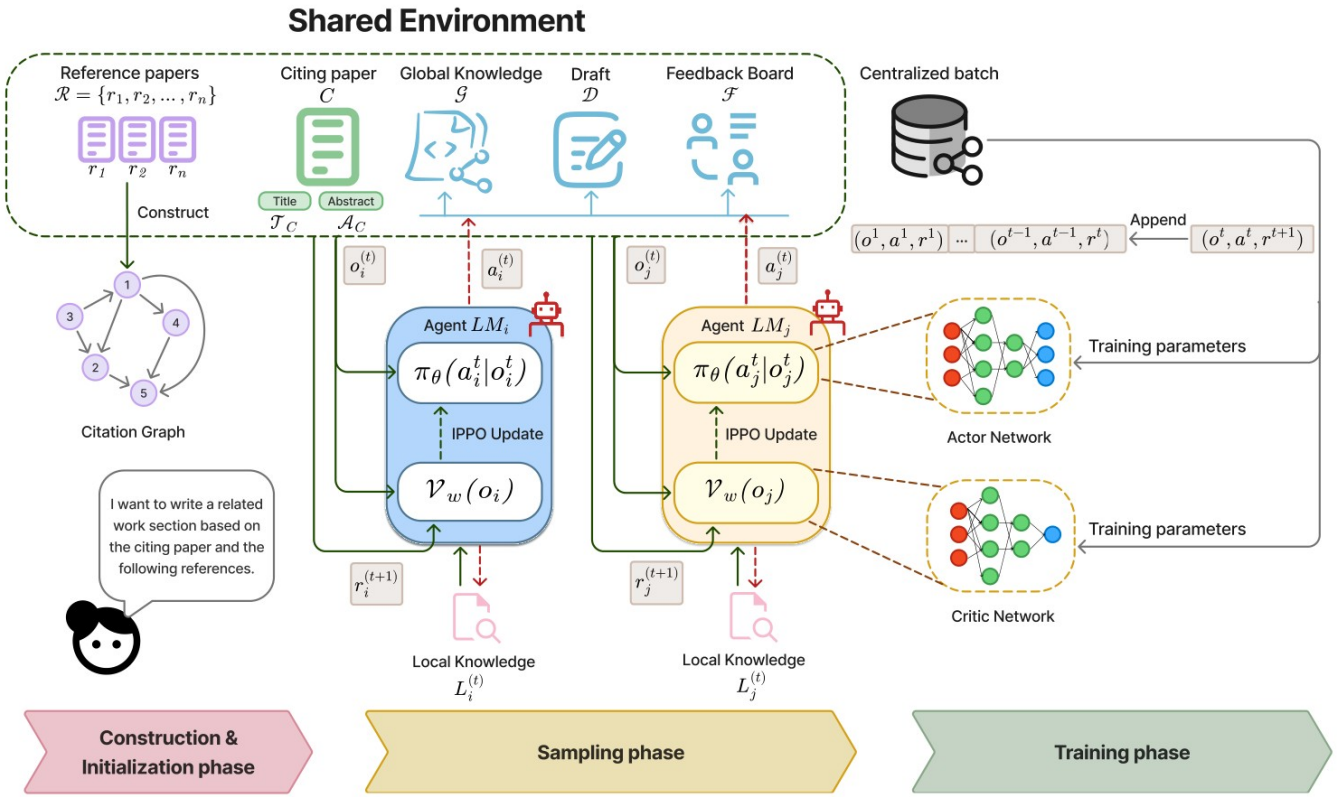
Non-stationary Drifting



B. T. Duc et al., "BECON: Belief-Conditioned Constrained Multi-Objective Reinforcement Learning under Drifting Preferences and Budgets", *NeurIPS 2026*.

Multi-agent Reinforcement Learning
Collaborative LLM Agents

- **Problem:** multi-agent LLM systems rely on rigid, hand-designed workflows
- **CREW:** each LLM agent is an RL policy that selects its next action
  - Retrieve · Disseminate · Compose · Critique
- Agents coordinate over a citation graph, trained with Independent PPO (IPPO)
- **Result:** better related-work generation at lower token cost



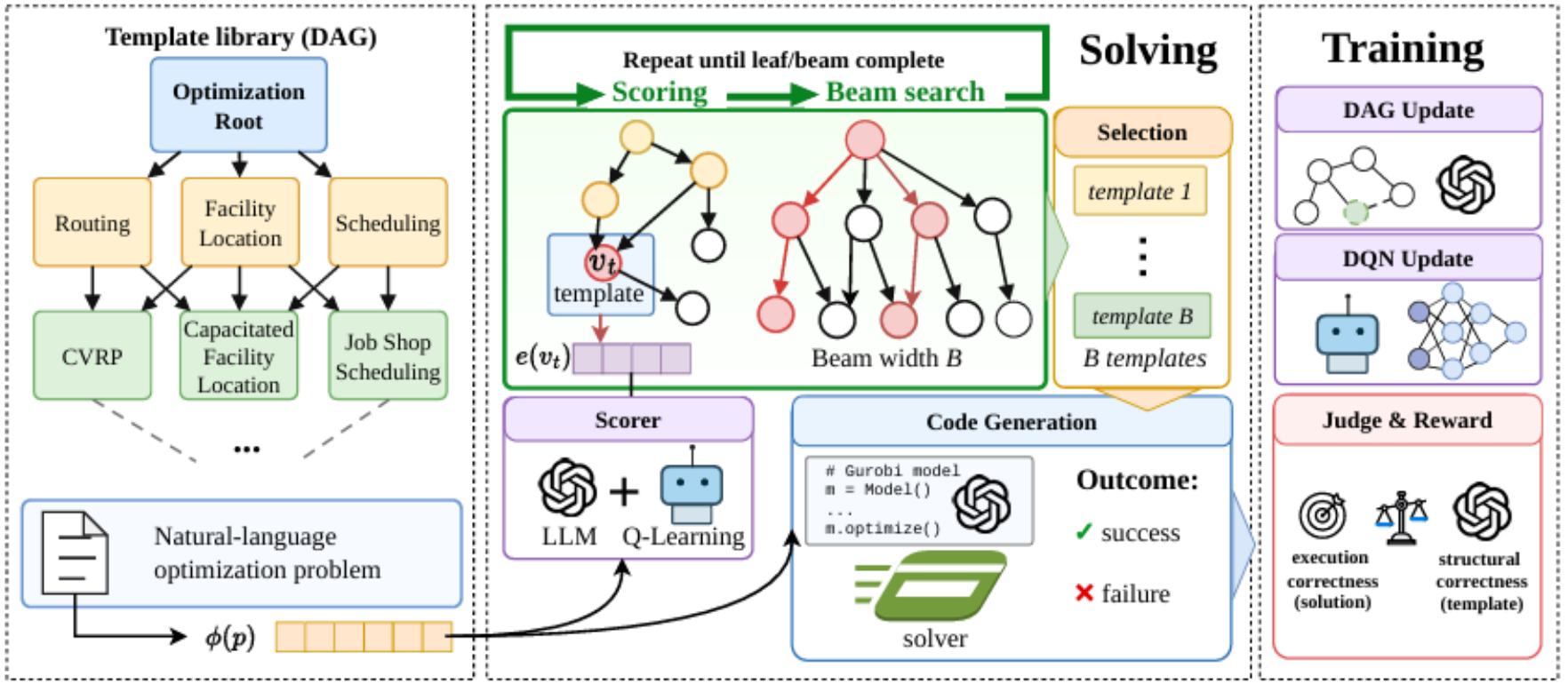
Overview of the CREW multi-agent framework

D. H. Dang et al., "Assembling the CREW: A Collaborative Multi-agent Reinforcement Learning Framework for Automated Related Work Generation", *EMNLP 2026*.

LLM for Optimization – Modelling & Automatic Heuristic Design

LLM for Optimization Modelling

COMPASS: Learned Template Retrieval for Autoformulation



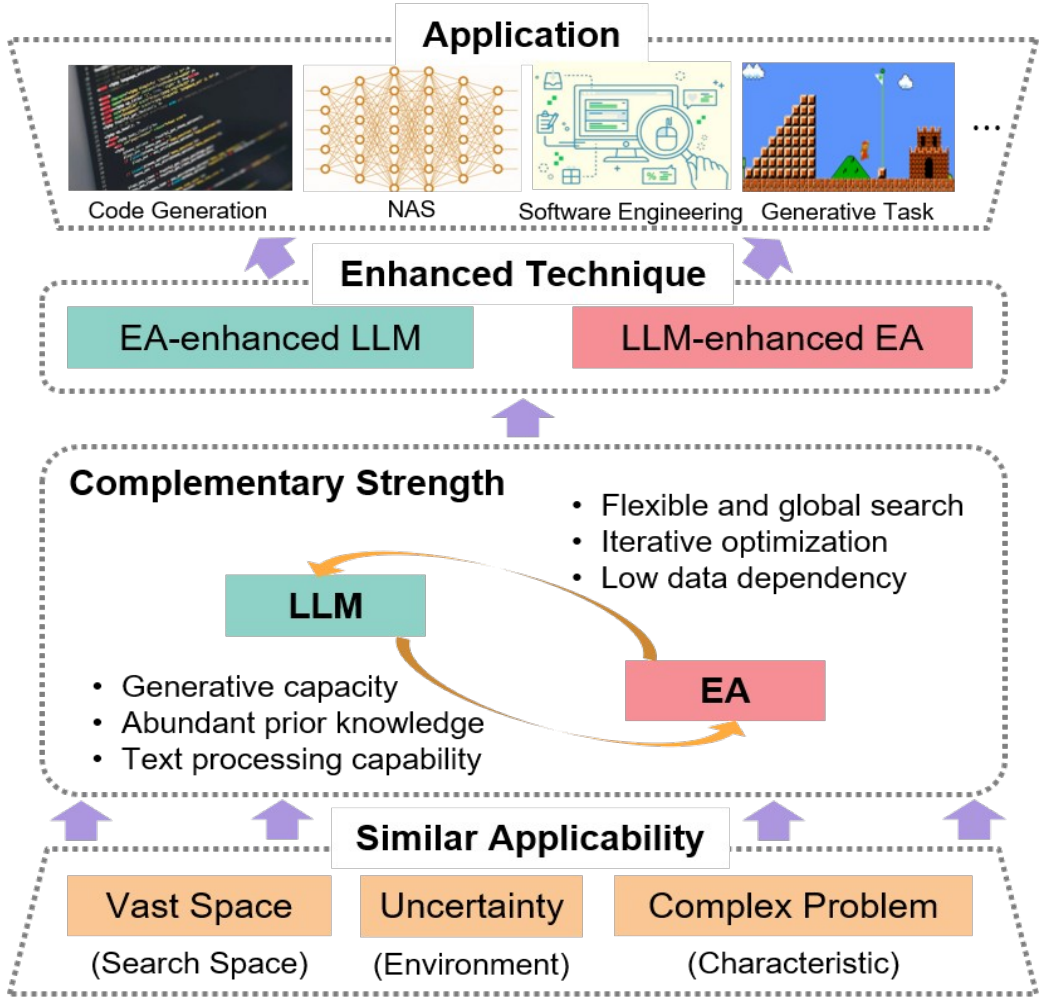
The template library is represented as a DAG, and retrieval is performed through a learned traversal policy guided by semantic priors and execution feedback.

N. L. M. Hoang et al., "COMPASS: Composable Policy-Amortized Structured Search for LLM-Based Optimization Modeling", *NeurIPS 2026*.

LLM-driven Automatic Heuristic Design

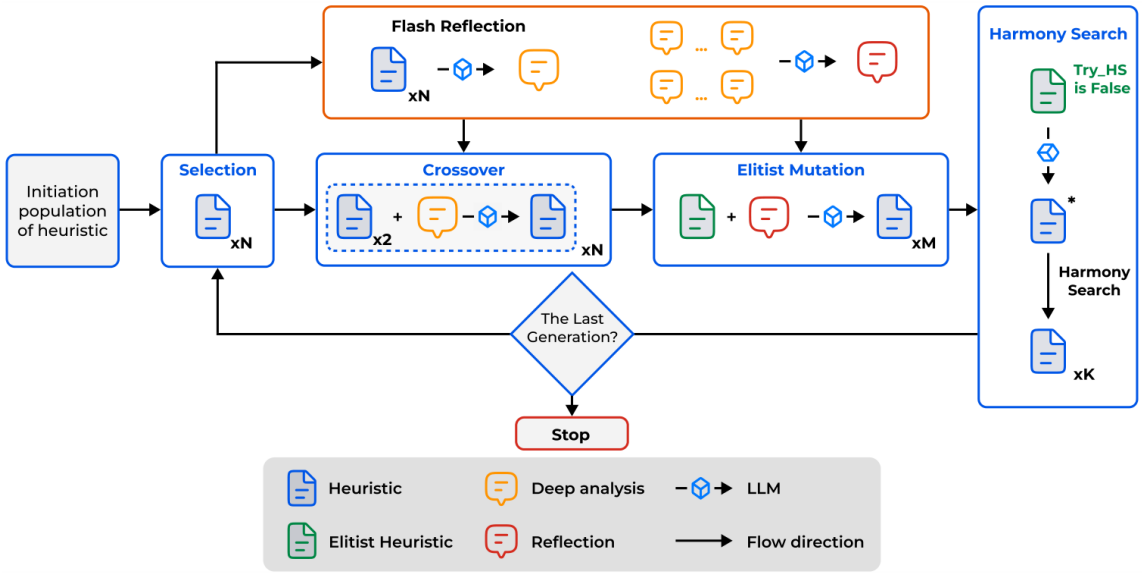
LLM & Evolutionary Computation

- **LLM-enhanced EA**
  - LLM-assisted Black-box Optimization
  - LLM-assisted Optimization Algorithm Generation
  - LLM Empower EA for Other Capabilities
- **EA-enhanced LLM**
  - EA-based Prompt Engineering
  - EA-based LLM Architecture Search
  - EA Empower LLM for Other Capabilities

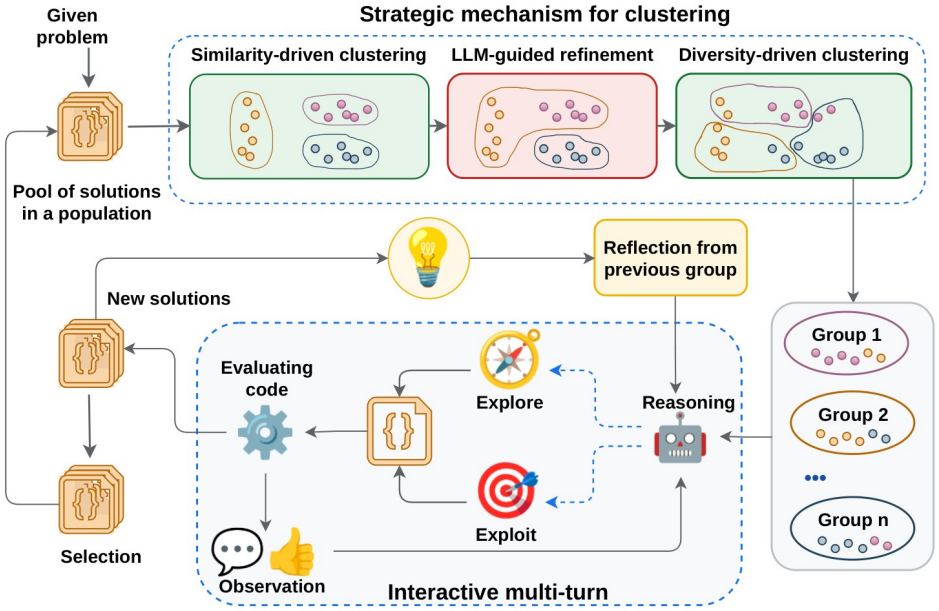


LLM-driven Automatic Heuristic Design

Diversity & Reflection in LLM-based Evolutionary Program Search



HSEvo: diversity-driven harmony search + GA with LLMs



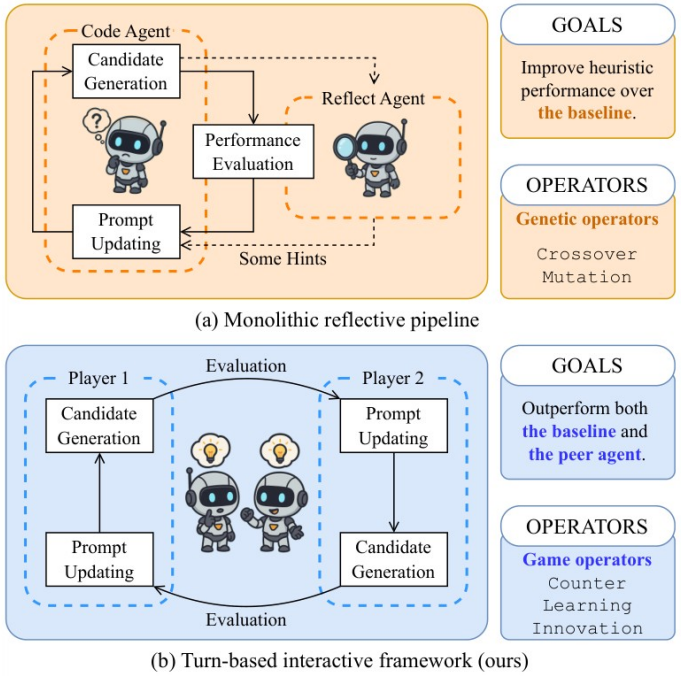
ReVEL: multi-turn reflective heuristic evolution

P. V. T. Dat et al., “HSEvo: Elevating Automatic Heuristic Design with Diversity-Driven Harmony Search and Genetic Algorithm Using LLMs”, *AAAI 2025*.

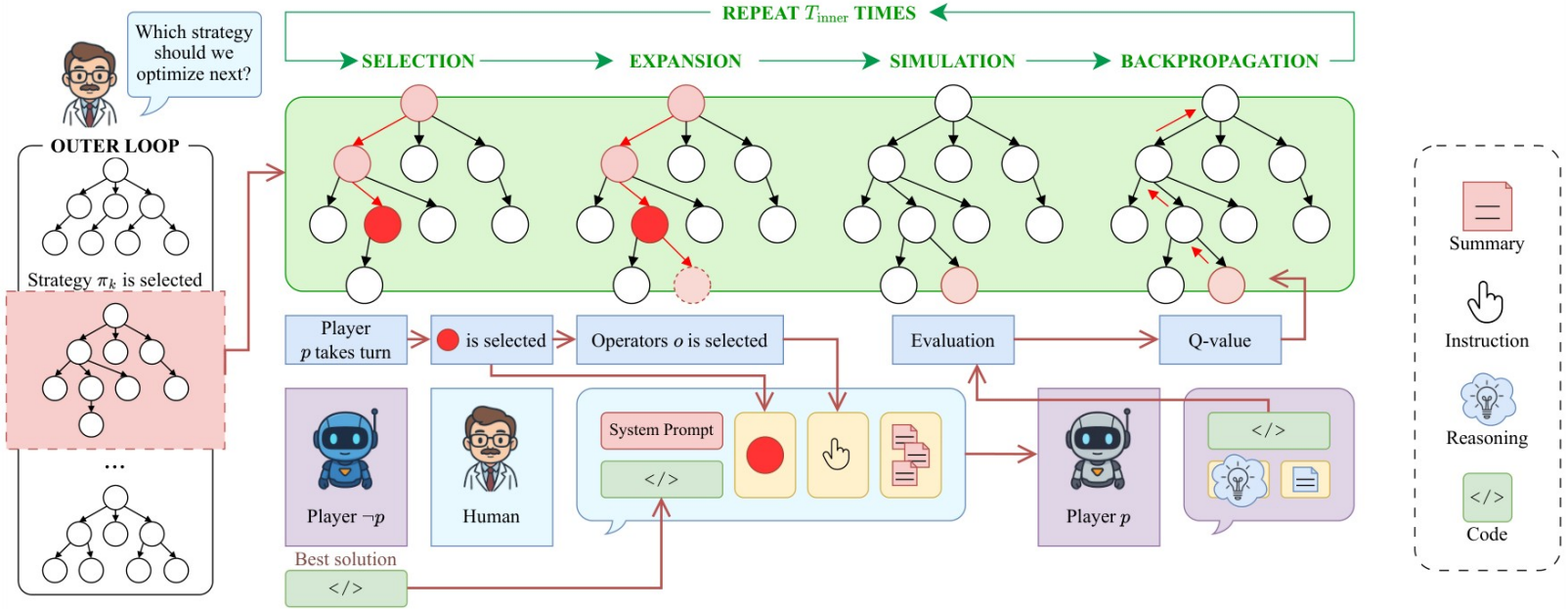
V. D. Cuong et al., “ReVEL: Multi-Turn Reflective LLM-Guided Heuristic Evolution via Structured Performance Feedback”, *EMNLP 2026*.

LLM-driven Automatic Heuristic Design

Multi-strategy Solver Design with Competing LLM Agents



Monolithic pipeline vs. turn-based interaction

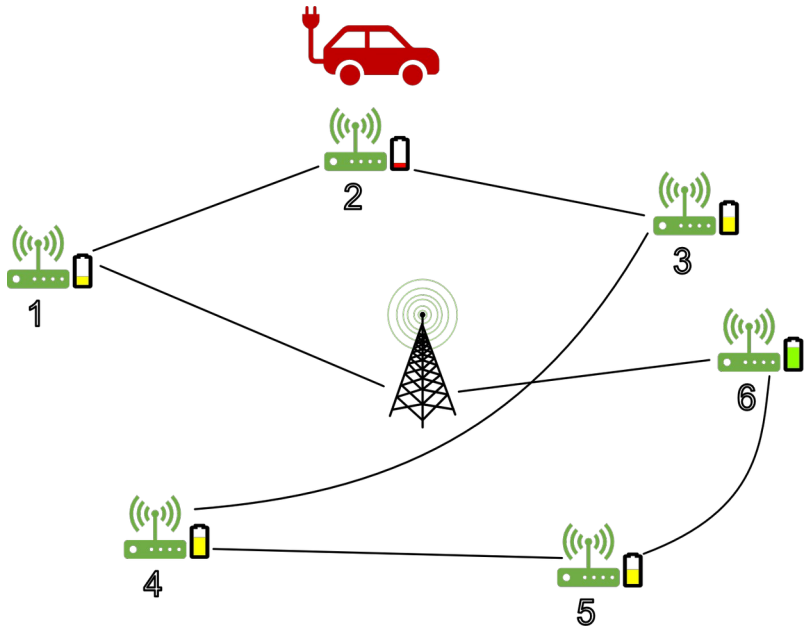


MOTIF: MCTS over strategies; two LLM agents take turns improving interdependent solver components

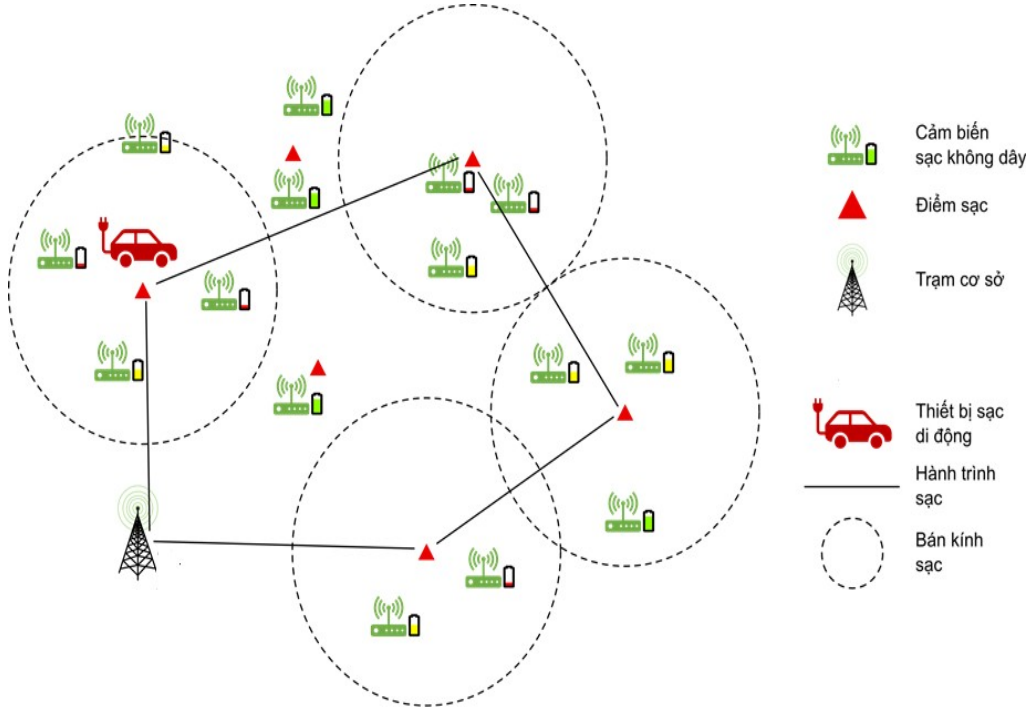
N. V. T. Kiet et al., "MOTIF: Multi-strategy Optimization via Turn-based Interactive Framework", *AAAI 2026*.

Optimization in Applications

Optimization in Applications
Charging Scheduling in Wireless Rechargeable Sensor Networks



Single-node charging model

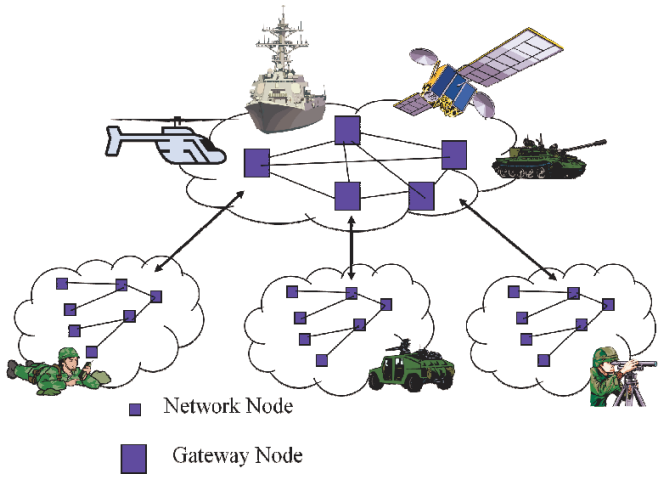


Multi-node charging model

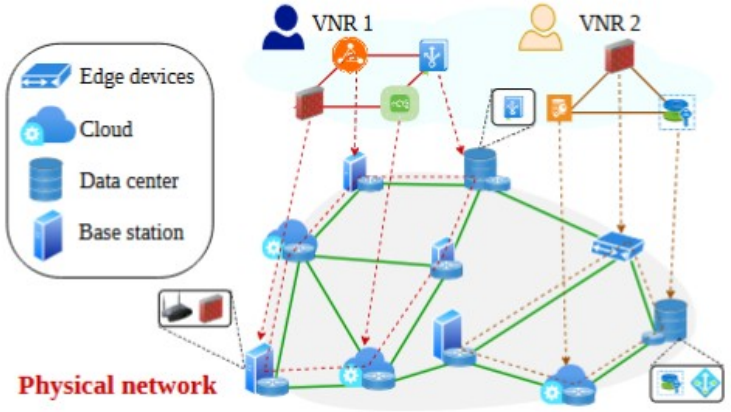
V. D. An et al., "An adaptive charging scheme for large-scale wireless rechargeable sensor networks inspired by deep Q-network", *Neural Computing and Applications*, 2024.

Optimization in Applications

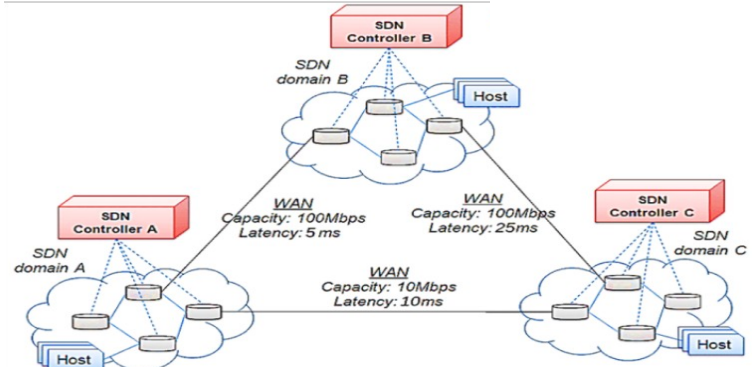
Network Optimization: Multi-domain Networks, SDN & NFV



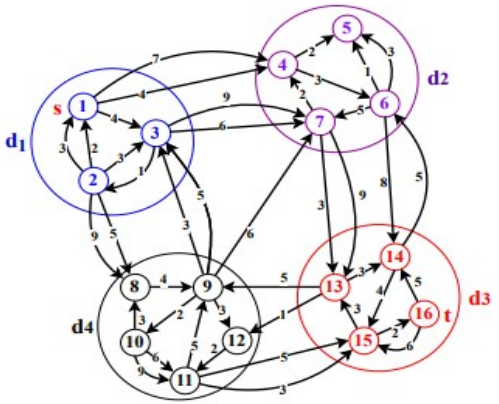
Military Communication



Network Function Virtualization



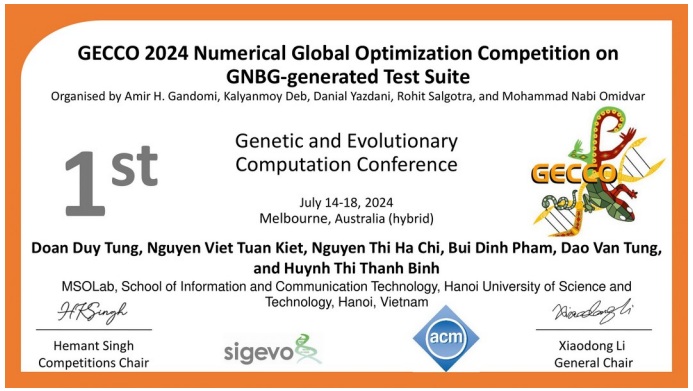
Software Defined Network



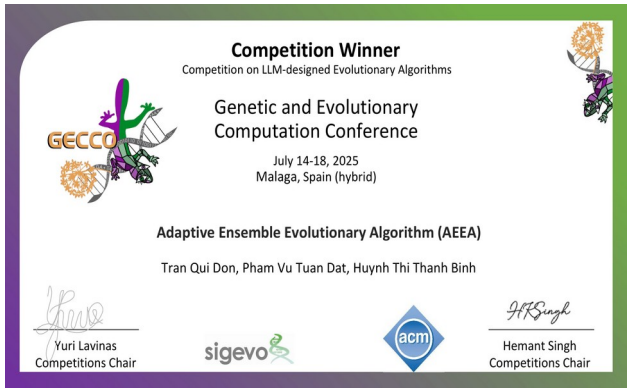
Inter-domain path

D. T. Anh et al., “MultiFatorial evolutionary algorithm with nodedepth encoding for inter-domain path computation under node-defined domain uniqueness constraint”, *Knowledge-Based Systems*, 2026.

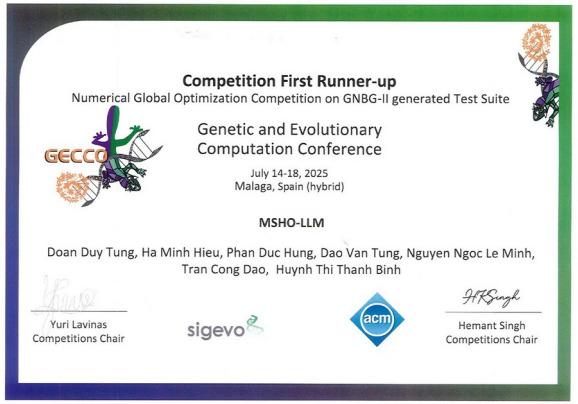
Awards



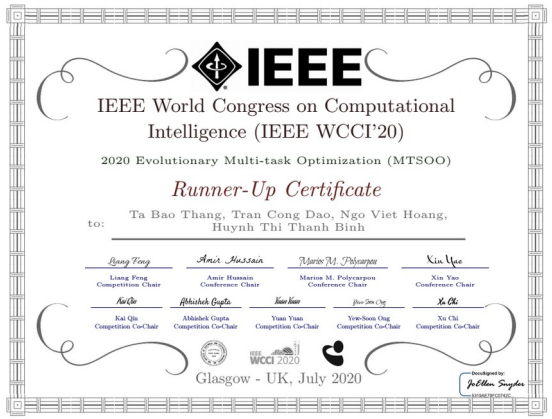
First Prize (GECCO 2024)



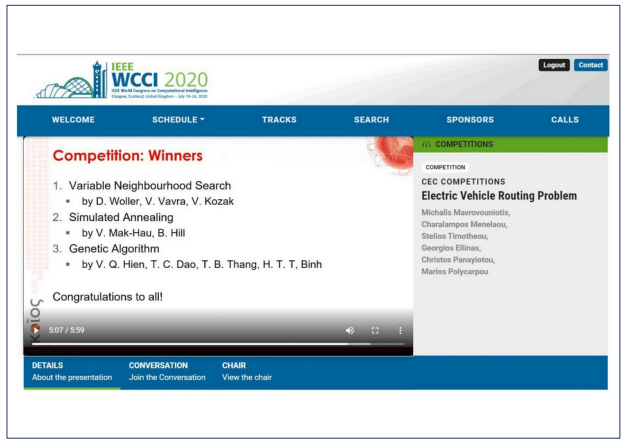
First Prize (GECCO 2025)



Runner-Up (GECCO 2025)



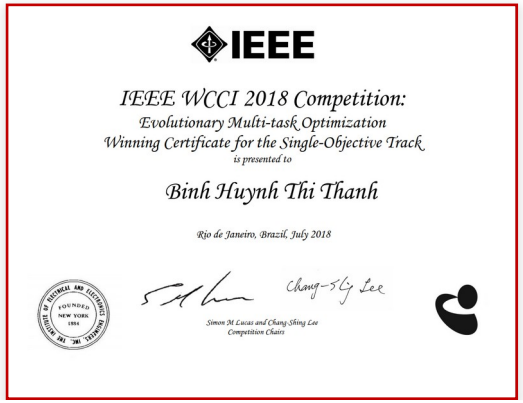
Runner-Up (WCCI 2020)



Third Prize (WCCI 2020)



First Prize (CEC 2021)



First Prize (WCCI 2018)



First Prize (WCCI 2022)

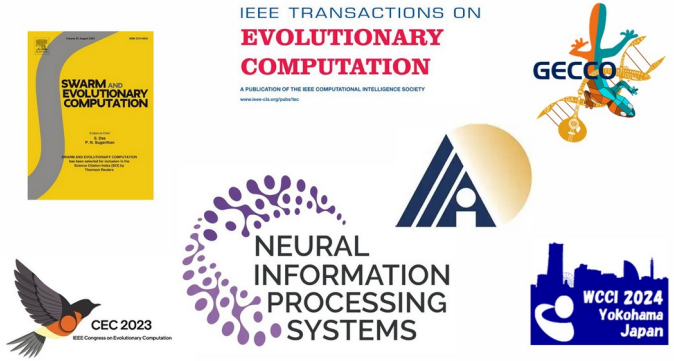
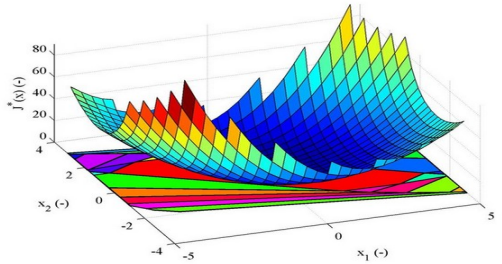


Table 2. The most prolific contributing authors devoted to MTO and MTEC.

Rank	Name	Affiliations	Address	E-mail	Total Number (Journal + Conference)
1	Yew-Soon Ong	Nanyang Technological University	Singapore	asysong@ntu.edu.sg	27 (17 + 10)
2	Abhishek Gupta	Singapore Institute of Manufacturing Technology (SIMTech)	Singapore	abhishek_gupta@simtech.a-star.edu.sg	25 (17 + 8)
3	Liang Feng	Chongqing University	Chongqing, China	liangf@cqu.edu.cn	24 (13 + 11)
4	Zexuan Zhu	Shenzhen University	Shenzhen, China	zhuzx@szu.edu.cn	15 (6 + 9)
5	Jinghui Zhong	South China University of Technology	Guangzhou, China	jinghuizhong@gmail.com	13 (7 + 6)
6	Maoguo Gong	Xidian University	Xi'an, China	gong@ieee.org	11 (5 + 6)
7	Huynh Thi Thanh Binh	Hanoi University of Science and Technology	Hanoi, Vietnam	binhht@soict.hust.edu.vn	11 (4 + 7)
8	Kay Chen Tan	City University of Hong Kong	Hong Kong, China	kaytan@cityu.edu.hk	10 (7 + 3)

Achievements

FRAMEWORKS



Novel algorithms
Efficient models

APPLICATIONS



Scheduling & planning
Logistics & transportation
Network design

EDUCATION



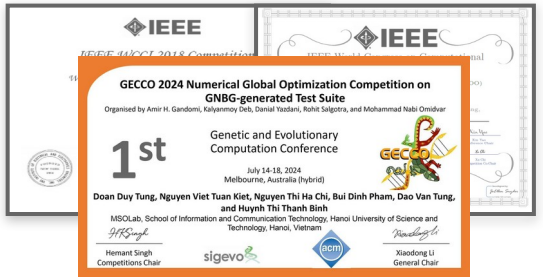
07 Postdoc & Graduated PhD
05 PhD students

PUBLICATIONS



Journal+conference:>180 papers
IEEE Transaction, IS, KBS, ...
NeurIPS, AAAI, GECCO, WCCI

AWARDS



WCCI 2024, GECCO 2024,
GECCO 2025

Acknowledgements









Thank you