

Research Interests

Language Modeling, Model Interpretability, and Data Influence, Agentic Systems and World Modeling, Symbolic Search and Evolutionary Computation.

Research Highlights

My recent research focuses on methods for structured search and reasoning in complex learning systems, including symbolic search, semantic genetic programming, and interaction-aware optimization. In particular, I study techniques for improving convergence and avoiding premature solutions by extracting and modeling latent interaction structure in high-dimensional search spaces.

These methods are related to problems in LLM reasoning and tool-use, where symbolic search can be interpreted as navigation over structured reasoning chains and decision trees. A potential future research direction is the application of these ideas to agentic systems, with the goal of enabling reliable, optimal decision-making in sequential, interactive environments.

Education

2020–2026 **Ph.D. in Computer Science**, *University of South Florida, Tampa, FL*

GPA: 4.0

Dissertation: *Extracting and Exploiting Latent Structures in Semantic Spaces For Efficient Symbolic Search and Black-Box Optimization*.

Advisor: Dr. Alessio Gaspar

Affiliation: CEREAL Lab.

2017–2019 **M.S. in Computer Science**, *University of South Florida, Tampa, FL*

GPA: 4.0

Thesis: *On Automation of Code Transformations for Concept Inventory Misconceptions*.

Advisor: Dr. Alessio Gaspar

2009–2015 **M.S. in Applied Physics**, *Kyiv National University (RECS), Kyiv, Ukraine*

GPA: 3.8

Thesis: *Parallel Routing Algorithms on Graphs for Heterogeneous Architectures*.

Advisor: Dr. Pogorilyy S.D.

Publications

- **Dmytro Vitel**, Anshuman Chhabra. 2026
First is Not Really Better Than Last: Evaluating Layer Choice and Aggregation Strategies in Language Model Data Influence Estimation.
The Fourteenth International Conference on Learning Representations (ICLR).
- **Dmytro Vitel**, Kok Cheng Tan, Alessio Gaspar, Paul Wiegand. 2025
Coordinate System Extraction as the Search Driver in Test-Based Genetic Programming.
Genetic and Evolutionary Computation Conference (GECCO), Association for Computing Machinery.
- **Dmytro Vitel**, Alessio Gaspar, Paul Wiegand. 2025
Robust Search for the Underlying Objectives in Black-Box Games with Binary Outcomes.
Applications of Evolutionary Computation: 28th European Conference, EvoApplications, (EvoStar).
- **Dmytro Vitel**, Stephen Steinle, John Licato. 2023
Enforcing Grammar in Code Synthesis with Transformers.
The International FLAIRS Conference Proceedings.

- **Dmytro Vitel**, Alessio Gaspar. 2022
 Analysis of Neutral Rewrite Operator Effects on Arithmetic Domain.
Genetic and Evolutionary Computation Conference Companion (GECCO).
Association for Computing Machinery
- **Dmytro Vitel**, Alessio Gaspar, Paul Wiegand. 2021
 A Neutral Rewrite Mutation Operator for Genetic Programming applied to Boolean Domain Problems.
The International FLAIRS Conference Proceedings.
- Alessio Gaspar, **Dmytro Vitel**, A.T.M. Golam Bari. 2019
 Lessons Learned from Available Parsons Puzzles Software.
2019 ASEE Annual Conference & Exposition Proceedings.
- Alessio Gaspar, A.T.M. Golam Bari, **Dmytro Vitel**, Kok Cheng Tan, Jennifer Albert, Rudolf Wiegand. 2019
 Board 59: Coevolutionary-aided Teaching: Leveraging the Links Between Coevolutionary and Educational Dynamics.
2019 ASEE Annual Conference & Exposition Proceedings.
- A.T.M. Golam Bari, Alessio Gaspar, R. Wiegand, **Dmytro Vitel**, Kok Cheng Tan, Stephen Kozakoff. 2019
 On the Potential of Evolved Parsons Puzzles to Contribute to Concept Inventories in Computer Programming.
2019 ASEE Annual Conference & Exposition Proceedings.
- Anisimov, A.; Pogorilyy, S.D.; **Vitel, D.Yu.** 2013
 About the issue of algorithm formalized design for parallel computer architectures.
Applied and computational mathematics.

Research Experience

- **2025-2026** **Semantic Genetic Programming with Symbolic Term Search Optimization**
 Developed a symbolic regression framework extending SBP-GP methods beyond single-point symbolic transformations by enabling multi-point mutation operators in symbolic search.
 - Investigates limitations of white-box atomic symbol inversion approaches in standard symbolic search methods.
 - Proposes a multi-point mutation mechanism designed to mitigate premature convergence caused by epistatic interactions in symbolic representations.
 - Implements a Symbolic Regression Solver for studying improved exploration of structured symbolic spaces.
 Ongoing work, expected completion Summer 2026. [solver code + experiments]
- **2025** **Data Influence Estimation Across LLM Layers and Aggregations**
 Evaluated the robustness of the cancellation effect as a proxy measure for layer selection in the context of influence estimation for determining detrimental and beneficial samples for the downstream tasks of large language models. Studied alternative aggregation strategies for layer-wise influence estimation, improving stability and reducing reliance on retraining-based evaluation. Designed and implemented large-scale experimental pipelines for influence signal extraction and analysis in distributed cluster environments.
ICLR 2026 (Advisor: Dr. Anshuman Chhabra) [code] [data]
- **2024-2025** **Robust Extraction of Latent Structure from Sparse Interactions**
 Investigated the problem of inferring latent interaction objectives in sparse and cold-start settings, motivated by recommender systems and online decision-making under limited feedback. Analyzed limitations of existing coevolutionary and optimization-based methods (e.g., DECA, COSA, hill-climbing approaches) in scenarios lacking mutual adaptation between interacting agents (user-item dynamics). Proposed a robust approximation framework for latent objective estimation that improves generalization to unseen interaction patterns in sparse feedback regimes.
EvoApplications (EvoStar), 2025 (Advisor: Dr. Alessio Gaspar) [code + experiments]
- **2024-2025** **Extracting and Exploiting Interaction Structure in Test-Based Genetic Programming**
 Investigated structured interaction modeling in symbolic search for genetic programming, focusing on multidimensional interaction dynamics in test-based evolutionary systems. Addressed the issue of dimension explosion (i.e., intransitive game) by introducing a structured subsampling strategy over interaction dimensions, improving tractability in high-dimensional search spaces. Designed an experimental pipeline comparing the proposed

method against multi-objective optimization baselines, including NSGA-II and NSGA-III with Pareto-layered sampling.

GECCO, 2025 (Advisor: Dr. Alessio Gaspar)

[code + experiments]

- **2023 Formalism Enforcement in Transformer Finetuning**
Developed a grammar-enforcement model head for transformer architectures to enable syntactically valid autoregressive generation of abstract syntax trees in semantic parsing tasks. Studied the effect of varying enforcement strength, from unconstrained to fully constrained generation, on model behavior and structural consistency.
FLAIRS, 2023 (Advisor: Dr. John Licato) [code + experiments]
- **2021–2022 Exploiting Axiomatic Systems for Navigating Neutral Networks in Symbolic Search**
Studied rewrite strategies in evolutionary symbolic search under redundancy and neutrality induced by introns and equivalent expressions. Proposed axiomatic and approximately neutral transformation operators to improve exploration and mitigate premature convergence in symbolic optimization benchmarks.
FLAIRS, 2021, GECCO, 2022 (Advisor: Dr. Alessio Gaspar) [code + experiments]
- **2018–2025 EvoParsons and EvoPIE: Coevolutionary Educational Systems**
Long-term collaboration in the development and maintenance of the EvoParsons and EvoPIE platforms for programming education and student knowledge modeling. Designed coevolutionary algorithms to identify and adapt to student misconceptions through interaction-driven task generation. Contributed to system implementation and deployment, supporting large-scale experimentation.
CEREAL lab (Advisor: Dr. Alessio Gaspar) [lab systems]
- **2020 Multicore Operating Systems Independent Study**
Developed a multicore operating system prototype with APIC configuration, multi-core initialization, and low-level synchronization primitives. Explored system-level parallelism and coordination trade-offs between shared-memory synchronization and structured execution models (actor models).
Independent Study (Advisor: Dr. Xinming Ou) [technical report]
- **2010–2026 Distributed Web Monitoring and Transaction Analysis System**
Designed and developed a globally distributed web monitoring system based on actor-model parallelism, supporting scalable coordination of monitoring agents across heterogeneous network environments. Investigated communication protocols and scheduling strategies for efficient large-scale monitoring and event-driven processing. Developed a microservice-based architecture with automated browser agents for transaction monitoring, exploring practical aspects of system reliability and security in adversarial or failure-prone environments.
HostTracker Ltd. [system]
- **2009–2014 Parallelization of Routing Algorithms on Heterogeneous Systems**
Conducted early research on parallel implementations of routing algorithms for clusters with GPGPU architectures (MPI with CUDA, DirectCompute), including formalization and efficient execution of heterogeneous computing.
Kyiv National University (Advisor: Dr. S. D. Pogorilyy)

Technical Skills

Programming Languages: Python, C#, F#, C/C++, SQL, Bash, Assembly

Machine Learning / AI: PyTorch, Hugging Face Transformers, OpenAI API

Systems: Linux, Distributed Systems (HPC), Multicore Programming, CUDA, Clouds (AWS, Azure)

Research Areas: Evolutionary Computation, Symbolic Search, LLM Reasoning, Agentic Systems

Tools: Containerization (Docker), Microservice Orchestration, Web Frameworks (.NET, Flask), ORMs (EF, SQLAlchemy), Databases (SQLite, MS SQL, Oracle).