Christopher Housholder

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Education

Missouri State University — Honors College *Aug 2022 – May 2027 (exp.)*
B.S. Applied Mathematics & B.S. Data Science (Honors Diploma) *Springfield, MO*

- **GPA: 4.0/4.0** (cumulative and major).
- Selected coursework: Real Analysis, Linear Algebra, Abstract Algebra, Statistical Theory, Algorithms, Differential Equations, Group Representations

Research Experience, Publications & Preprints

Graph Theory & Additive Combinatorics *Apr 2023 – Present*
Undergraduate Researcher (Advisor: Dr. Steven Senger) *Missouri State University*

- **Bounds on distinct and repeated dot product trees**, Autry, Gunter, Housholder, Senger. *CANT 2024 Proceedings.*
- First research paper; contributed supporting arguments, computations, and exposition within a collaborative combinatorics project.
- **VC-dimension of subsets of Hamming graphs**, Housholder, Mangiapanello, Senger. *Submitted to Graphs & Combinatorics*, 2025; presented at CANT 2025.
- Developed original sharp VC-dimension bounds for structured subsets of Hamming graphs using extremal combinatorics and incidence-style arguments.
- Primary contributions include several technical theorems and lemmas, shatter-configuration algorithm construction, proof and paper writing.
- Project reflects transition from collaborative participation to significant independent theoretical contribution.

Transformer-Based Time Series Forecasting *Jan 2025 – Present*
Undergraduate Researcher (Advisor: Dr. Yifan Zhang) *Missouri State University*

- **Rethinking the Encoder–Decoder Structure for Transformer-Based Time Series Forecasting**, Housholder et al. *Accepted (Regular Paper), ITNG 2026.*
- Led project, experimental design, and analysis; conducted systematic ablations comparing encoder-only, decoder-only, and full architectures across multiple forecasting models and datasets.
- Built reproducible PyTorch pipelines with experiment tracking; evaluated accuracy, parameter count, and runtime tradeoffs.
- Results show decoder-only architectures frequently outperform full encoder–decoder models, challenging standard design assumptions.

Big Data Algorithms & Polynomial Interpolation *Aug 2025 – Present*
Undergraduate Researcher (Advisor: Dr. Hazhar Rahmani) *Missouri State University*

- Solo research project on scalable polynomial interpolation and extrapolation algorithms for large datasets.
- Developed new recurrence-based quotient-ring interpolation framework; implemented and benchmarked MapReduce/PySpark pipelines.
- Designed large-scale synthetic and real-data experiments evaluating correctness, numerical stability, and performance scaling.
- **Manuscript in final preparation**: sole author; advisor serves in supervisory and proofreading role only.

Nonlocal Curvature & PDE Methods *Jan 2025 – Present*
Undergraduate Researcher (Advisor: Dr. Animesh Biswas) *Missouri State University*

- Research in nonlocal geometric PDEs, focusing on curvature operators defined via integrable kernels and their analytical properties.
- Moved from study of nonlocal mean curvature, classical curvature, and related boundary-value methods for constant curvature problems.
- Current work (Spring 2026) transitions to a concrete research problem in this framework, emphasizing differentiability of the nonlocal curvature functional and rigidity phenomena under minimal boundary regularity.
- Project aligns with recent work on integrable-kernel nonlocal curvature and extensions of Alexandrov's moving plane method.

Presentations, Conferences & Awards

- **23rd International Conference on Information Technology: New Generations (ITNG 2026)** — presenting author (regular paper).
- **CANT (Combinatorics & Additive Number Theory)** — work presented (by Dr. Senger): 2024, 2025.
- MAKO Undergraduate Research Conference: 2024, 2025.
- **1st Place** — CNAS Undergraduate Research Symposium, 2025 (Time-Series Transformers / Dozerformer line).
- **1st Place** — CNAS Undergraduate Research Symposium, 2025 (VC-dimension of Hamming Graphs).
- **2nd Place** — CNAS Undergraduate Research Symposium, 2024 (Dot Product Trees).
- **2nd Place** — CNAS Undergraduate Research Symposium, 2025 (Nonlocal Curvature).

Honors & Scholarships

- Board of Governor's Scholarship, 2022–present.
- Dean's List, 2022–present.
- Missouri State University Honors College (Honors Diploma track).
- Ed Huffman Mathematics Scholarship 2024

Technical Skills

- **Mathematics:** Combinatorics, Graph Theory, Additive Number Theory, VC-dimension methods, Linear Algebra, Abstract and Commutative Algebra, Spectral Methods, Nonlocal Curvature, Partial Differential Equations (exposure).
- **Mathematical Research Skills:** Lemma discovery, extremal configuration analysis, proof strategy development, rigorous proof writing, LaTeX-based mathematical exposition, reading advanced research papers.
- **Machine Learning & Modeling:** Transformer architectures, encoder/decoder ablations, time-series forecasting, experimental design, optimization, model evaluation, parameter and runtime analysis.
- **Programming & Scientific Computing:** Python (advanced), PyTorch, NumPy/SciPy, C/C++, Java, SQL; algorithm implementation, numerical experimentation, and performance benchmarking.
- **Data & Systems:** Reproducible research pipelines, experiment tracking, large-scale benchmarking, MapReduce and PySpark workflows for big-data algorithms.
- **Software & Tools:** Git, Linux-based development environments, LaTeX, shell scripting; basic web technologies (HTML/CSS/JavaScript).
- **Languages:** Intermediate Korean (speaking and reading).

Leadership & Service

- **President**, ACM (Missouri State University Chapter) — led technical events, peer learning, and student programming community initiatives.
- **Cofounder & Secretary**, Webster County 100 Club (nonprofit) — bereavement support for emergency services; organizational operations and outreach.
- Research group lead (informal) — mentoring newer students in reading papers, presenting results, and maintaining reproducible workflows.

Additional Experience

Omni Manufacturing *Jan 2024 – Present*
Co-Owner / Software & Systems (CIO role) *Houston, TX*
– Built internal software and data workflows; developed and maintained company web presence and analytics; supported customer-facing technical communication.

Housholder Law Firm *Aug 2021 – Present*
Secretary *Springfield, MO*
– Legal document management, filing, and administrative support; detail-oriented workflow and professional communication.