

Kazi Tasnim Zinat

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Over five years of experience in sequential data analysis using machine learning and visual analytics. Designed LLM-powered systems for structured knowledge extraction, and implemented neural network architectures for causal inference. Developed domain-specific benchmarks to evaluate Multimodal Language Models. Experienced with Python, PyTorch, AutoGen, React, D3.js, scikit-learn, LlamaIndex and HPC cluster.

EDUCATION

University of Maryland, College Park

Aug 2019 – Present

Ph.D. Candidate in Computer Science (Advisor: Leo Zhicheng Liu)

College Park, MD

Thesis: Beyond Domain Boundaries: Enhancing Generalizability of Event Sequence Visual Analytics Research

University of Maryland, College Park

Aug 2019 – May 2024

Master of Science in Computer Science; GPA: 3.97/4

College Park, MD

Bangladesh University of Engineering & Technology

Feb 2013 – Sep 2017

Bachelor of Science in Computer Science and Engineering; GPA: 3.71/4

Dhaka, Bangladesh

EXPERIENCE

Applied Science Research Intern - Machine Learning

May 2023 - August 2023

Amazon Web Services (AWS), Bedrock Generative AI Team

Santa Clara, CA

- Engineered an intervention-aware hybrid Transformer–CNN point-process model (event + intervention embeddings, weighted fusion, temporal encodings) trained on AWS SageMaker for long-range + local temporal patterns.
- Achieved 88% RMSE reductions on industrial maintenance logs and ~ 50% lower negative log likelihood in simulated datasets compared to baseline; identified treatment-effect shifts aligned with clinical literature.

Applied Science Research Intern - Machine Learning

May 2022 - August 2022

Amazon Web Services (AWS), Machine Learning Solutions Lab

Santa Clara, CA

- Formulated a theoretical framework extending Rubin’s causal model for temporal point processes; extended average treatment effect beyond i.i.d. data and formalized causal relation shifts under interventions.
- Implemented counterfactual treatment effect estimator with intervention-aware propensity score matching.

Graduate Research Assistant - Human Computer Interaction

Spring 2021 – Present

University of Maryland (Human-Data Interaction Lab)

College Park, MD

- Created **ProcVQA**, the first benchmark for evaluating vision language models on mined process visualizations; curated 118 charts with 2,583 ground-truth tuples, and 144 expert-validated questions; evaluated 21 models.
- Building a **RAG-based knowledge base** for event-sequence analysis; extracted structured data from 100+ research papers with added contextual chunking, multi-modal figure indexing and hybrid retrieval.
- Designing a **4-agent, human-in-the-loop framework**, decomposing natural-language goals into executable code for event-sequence analytics: Planner→Intent→Technique→Code Executor, gated by user approvals

Graduate Research Assistant - Bioinformatics

Fall 2019 – Summer 2020

University of Maryland (HCBraVo Lab)

College Park, MD

- Co-authored scTreeViz BioConductor package for interactive single-cell RNA-seq analysis with hierarchy
- Implemented clustering methodology and PCA-based dimensionality reduction for genomic data visualization

SELECTED PUBLICATIONS

P1. *ProcVQA: Benchmarking the Effects of Structural Properties in Mined Process Visualizations on Vision–Language Model Performance* (2025).

K.T. Zinat, S.M. Abrar, S. Saha, S. Duppala, S.N. Sakhamuri, Z. Liu. **EMNLP Findings**.

P2. *Uncovering Causal Relation Shifts in Event Sequences under Out-of-Domain Interventions* (2025).

K.T. Zinat, Y. Zhou, X. Lyu, Y. Wang, P. Xu. **ICANN**.

P3. *A Multi-Level Task Framework for Event Sequence Analysis* (2024).

K.T. Zinat, S.N. Sakhamuri, A.S. Chen, Z. Liu. **IEEE VIS (TVCG)**.

P4. *A Comparative Evaluation of Visual Summarization Techniques for Event Sequences* (2023).

K.T. Zinat, J. Yang, A. Gandhi, N. Mitra, Z. Liu. **EuroVis** (Computer Graphics Forum).

P5. *Comparing Native and Non-native English Speakers' Behaviors in Collaborative Writing* (2025).

Y. Chen, Y. Xiao, **K.T. Zinat**, N. Yamashita, G. Gao, Z. Liu. **ACM CHI**.

W1. *Evaluating VLMs as Accessibility Bridges for Process Visualizations* (2025).

K.T. Zinat, S.M. Abrar, S. Duppala, S.N. Sakhamuri, Z. Liu. **CVPR VizWiz Grand Challenge Workshop**.

W2. *Comparing Native and Non-native English Speakers' Behaviors* (2025).

Y. Chen, Y. Xiao, **K.T. Zinat**, N. Yamashita, G. Gao, Z. Liu. **NAACL In2Writing Workshop**.

Full list available at [Google Scholar](#).

RESEARCH PROJECTS

Human-in-the-Loop Multi-Agent Event Sequence Analysis | *AutoGen, LangChain, Conversational AI* 2025

- Operationalized a **domain-specific task framework** (P3) using Autogen utilizing role-specific prompts.
- Agents choose methods and parameters with full traceability, following structured workflow: user goal → planning/decomposition → framework mapping → technique selection → code execution → review/approval loop
- Implemented a sandboxed execution environment logging outputs/errors for correction; supports iterative human feedback and approval before termination

Event Sequence Knowledge Base | *RAG, Document AI, LlamaIndex, Docling, FastAPI, React, Pydantic* 2025

- Implemented an ETL pipeline with multimodal extraction and grounded recommendations with inline citations.
- Deployed **hybrid retrieval** (vector + BM25) and LLM-based generation to mitigate hallucination and return source-attributed recommendations via FastAPI backend powering a React chat interface for non-technical users.

ProcVQA: VLM Benchmark for Process Visualizations (P1, W1) | *VLM, Multi-modal AI, Benchmark* 2024-25

- Evaluated 21 state-of-the-art VLMs (including GPT-4.1, Claude-3.7 Sonnet, Gemini-2.5 Pro Thinking, Llama-4, Qwen) using zero-shot protocol; exposed **19-56%** performance drop from single-hop to multi-hop reasoning.
- Analyzed structural effects and showed hallucinations rise steeply with edge density e.g., Gemini-2.5-Pro-Thinking **0.3% → 10.1% (33.6×)** from low → high edge density; graphs consistently hardest vs. trees/linear sequences.
- Released pipeline & dataset with standardized rendering to isolate structure effects; documented instruction-following failures and failure modes (edge-value fabrication, node fusion, processing collapse)

Causal Inference Framework for Event Sequences (P2) | *PyTorch, Transformer, CNN, Temporal Modelling* 2022-24

- Proposed analysis protocol for average treatment effect estimation under interventions; performed ablation studies injecting three different intervention types, showing robustness of framework to intervention complexity.
- Implemented multi-headed self-attention mechanisms and multi-objective training (NLL + cross-entropy + L2) with cross validation and efficient data binning; validated with experiments across simulated data and real-world logs.

Multi-Level Task Framework for Event Sequence Analysis (P3) | *Qualitative Analysis, Open and Axial Coding* 2023-24

- Developed domain-agnostic framework analyzing 58 visualization systems across 16 venues
- Created 4-level taxonomy (6 objectives, 5 intents, 15+ strategies) with action-input-output-criteria quartets
- Established theoretical foundation for intelligent assistance tools and executable benchmarks

Visual Summarization Technique Benchmarking (P4) | *Crowdsourcing, Python, React, Mixed-Effect Model* EuroVis 2023

- Conducted controlled experiment: 108 visual summaries, 180+ participants, 1,620 observations across 6 datasets
- Reimplemented 3 techniques (CoreFlow, SentenTree, Sequence Synopsis) with standardized visual encoding
- Identified accuracy-efficiency tradeoff: Technique achieving highest quality required longest time

TECHNICAL SKILLS

Languages: Python, JavaScript, Java, R, C++

AI/ML: PyTorch, Transformers, HuggingFace, scikit-learn, AutoGen, LlamaIndex, Neural Networks

Web Development: React, FastAPI, HTML5/CSS3, Node.js

Data Visualization: D3.js, Tableau, Plotly, Leaflet.js, React

RELEVANT COURSEWORK

Graduate (UMD): Multimodal Foundation Models, Deep Learning, Foundations of Deep Learning, Causal Inference and Evaluation Methods, Computational Linguistics, Information Visualization, Interactive Data Analytics, Advanced Numerical Optimization, Algorithms for High-Throughput Genomics

Undergraduate (BUET): Data Structures, Algorithms, Artificial Intelligence, Machine Learning, Software Engineering, Computer Graphics

SELECTED ACHIEVEMENTS & SERVICE

Conference Reviewer: IEEE VIS (2023, 2025), EuroVis (2025), ACM CHI (2025), PacificVis (2025); received “Highly Useful” recognition at IEEE VIS, PacificVis, EuroVis

Grants & Fellowships: AWS Cloud Credit for Research (\$5000, 2023), Jacob K. Goldhaber Travel Grant (2023), Grace Hopper Celebration (GHC) Student Scholar (2023), Dean’s Fellowship (UMD, 2019–2020)

Teaching: Served as Teaching Assistant for 7 courses, including Information Visualization, Programming Languages, Bioinformatics Algorithms, and Web Development