

Hao Jiang, Ph.D.

Postdoctoral Fellow

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I am an accomplished Postdoctoral Researcher at Harvard University. My research involves self-designing blockchain and large language models. They have many potential applications in a variety of industries. Previously, I earned my Ph.D. in Computer Science from the University of Chicago, where I specialized in Databases, Distributed Systems, and Machine Learning. I have authored several publications in leading academic conferences. With six years of experience as a Software Engineer, I am well-versed in Java, C++, and Python. I also have experience leading small teams.

Education

- **The University of Chicago** Chicago, IL
Ph.D. Computer Science 2015 – 2021
– Advisor: Aaron J. Elmore
- **Clarkson University** Potsdam, NY
M.Sc. Computer Science 2012 – 2015
– Advisors: Jeanna N. Matthews
- **Fudan University** Shanghai, China
B.Sc. Computer Science 2001 – 2005
– Advisor: Liang Zhang

Publications

1. Chunwei Liu, **Hao Jiang**, John Paparrizos, Aaron J. Elmore *Decomposed Bounded Floats for Fast Compression and Queries VLDB 2021*
2. **Hao Jiang**, Chunwei Liu, John Paparrizos, Aaron J. Elmore *Good to the last bit: Data-Driven Encoding with CodecDB SIGMOD 2021*
3. **Hao Jiang**, Chunwei Liu, Qi Jin, John Paparrizos, Aaron J. Elmore, *PIDS: Attribute Decomposition for Improved Compression and Query Performance in Columnar Storage, VLDB 2020*
4. Chunwei Liu, McKade Umbenhower, **Hao Jiang**, Aaron J. Elmore, *Mostly Order Preserving Dictionaries, ICDE 2019*
5. **Hao Jiang**, Aaron J. Elmore, *Boosting Data Filtering on Columnar Encoding with SIMD, DaMon 2018*
6. Dixin Tang, **Hao Jiang**, Aaron J. Elmore, *Adaptive Concurrency Control: Despite the Looking Glass, One Concurrency Control Does Not Fit All, CIDR 2017*
7. **Hao Jiang**, Yaoqing Liu, Jeanna N. Matthews, *IP Geolocation Estimation using Neural Networks with Stable Landmarks, IEEE INFOCOM Workshop GI 2016*

8. Wenjin Hu, Long Zhang, **Hao Jiang**, Jeanna N. Matthews, *A Quantitative Study of Virtual Machine Live Migration, CAC 2013*

Research Experience

- **Harvard University** Boston, MA
Postdoctoral Researcher with Prof. Stratos Idreos *Oct 2021 – Now*
 - **Blockchain Calculator:** Build a self-designing blockchain system that adapts to workloads to provide high-throughput and low-latency
 - **Detachable Memory in Large Language Models:** Develop a small and detachable memory component for large language models. These components maintain domain knowledge and long-term memory and can be trained independently from the main LLM. They grant the LLM different abilities.
- **The University of Chicago** Chicago, IL
Research Assistant under Prof. Aaron J. Elmore *Sept. 2015 – Aug. 2021*
 - **CoLSM: Lightweight Encoding in LSM-trees** Explore using lightweight encodings to LSM-trees to improve lookup efficiency. Design a LSM-tree that supports using different data structure at each level to improve merge performance.
 - **PIDS: Exploring Unsupervised Pattern Inference in String Attributes** Design a new compression algorithm that discover patterns in string attributes, and uses the pattern to extract and compress sub-attributes independently. This result is published on VLDB.
 - **Encoding-Aware Columnar Database** Design and build a columnar database query engine that uses encoding knowledge to speed up database queries. Our query engine executes queries 5-30x faster than the state-of-the-art. This result is published on SIGMOD.
 - **Data-Driven Database Encoding Selection.** Using Machine Learning Techniques to select the most efficient data encoding schema for a given columnar database.
 - **SBoost: Using SIMD Instruction to speed up Database Operator.** Design an innovative algorithm for querying compressed data without decompression using SIMD Instructions.
 - **Auto-Encoder in Data Compression.** Design an auto-encoder network to compress data for approximation queries.
 - **Pattern as a Foreign Language.** Using Recurrent Neural Network to discover and extract hidden pattern from database columns.
 - **Distributed Storage on ZCCloud.** Design and implement a simulator that study the system availability and performance of Cassandra distributed key-value store running on Zero-Cabon Cloud Datacenter platforma using stranded power.
- **Clarkson University** Potsdam, NY
Research Assistant under Prof. Jeanna N. Matthews *Sept. 2012 – Jul. 2015*
 - **Internet Toplogy Platform.** Design, implement and experiment several heuristic based partitioning methods on Internet Topology. Experiment on building a Internet Topology Platform support thirdparty data analysis programs to access Internet structure with ease.
 - **GreenDataCenter Project.** Participate in GreenDataCenter (GDC) Project. Design and implement a simulation environment to study the feasibility of using pure green energy, such as solar and wind to power distribute data center and provide service with high availability.
 - **IP Geolocation.** Proposed an innovative method of locating the physical location of arbitrary IP address with a two-tier neural network. Independently designed and implemented the system.

- **Phishing website detection with logo recognition.** Used SVM to extract the embedded logos of known websites from a large image to identify phishing websites based on these logos. Independently designed and implemented the system.

- **Fudan University**

Shanghai, China

Research Assistant under Prof. Liang Zhang

Sept. 2003 – Jul. 2005

- **Grid Computing.** Study the feasibility of using IBM Globus Platform to build a grid-computing system for bio-informatic computation and database service.

Work Experience

- **Harvard University**

Cambridge, MA

Postdoctoral Fellow

Oct. 2021 – Present

- Research on Blockchain and Large Language Models

- **Facebook Inc.**

Menlo Park, CA

Software Engineer Intern

July. 2018 – Sept. 2018

- Design, implement and evaluate a load balance algorithm for PHP requests

- **Baidu Inc.**

Shanghai, China

System Architect

Sept. 2011 – Aug. 2012

- Design and implement a customizable MySQL replication framework. This framework intercepts message sent by a master database during MySQL master-slave replication, rewrite it with user provided function and send it to slave database. This framework allows an easy customization of replication behaviors.
- BigData Analysis System using Hadoop. Lead a 4-developer team to design and develop a Hadoop-based BigData analysis system. The system processes a daily data volume of over 10 terabytes.

- **OOCL Co. Ltd.**

Shanghai, China

Senior Software Engineer

Sept. 2005 – Sept. 2011

- Production Server JVM Performance Tuning. Design and implement a log analysis system for production environment JVM resource leak and memory leak tracing and tuning.
- Design and optimization of an accounting system containing billions of rows and processing millions of queries hourly based on Oracle DBMS.

Teaching Experience

- **Introduction to Database**

The University of Chicago

Teaching Assistant

Spring 2018

- Holding office hours and answer student questions

- **Computer Security**

The University of Chicago

Teaching Assistant

Autumn 2015, Spring 2016

- Holding office hours and answer student questions

- **Introduction to Computer Science**

Clarkson University

Teaching Assistant

Fall, 2014

- Holding Labs, lectures and recitation classes

- **Calculus I**

Clarkson University

Teaching Assistant

Fall 2013

- Led recitation classes guiding students through difficult problems and reviewing course material.

- **Linear Algebra and Differential Equations**

Clarkson University

Teaching Assistant

Fall 2012

- Proctoring exams and grading

Presentations

- *CodecDB: A Compression Aware Columnar Database*
 - SIGMOD 2021, Online, June 2021.
- *Attribute Decomposition for String Compression*
 - VLDB 2020, Online, June 2020.
- *Efficient Query on Compressed Data with SIMD*
 - DaMoN 2018, Austin, TX. June 2018.
- *Data-Driven Lightweight Encoding Selection*
 - CERES Research Summit - The University of Chicago, Chicago, IL. March 2017.
- *An Log-based Dynamic Partitioning Method*
 - System Seminar - The University of Chicago CS System Group, Chicago, IL. Oct 2016.
- *IP Geolocation using Two-tier Neural Network*
 - 6th Global Internet Symposium, San Francisco, CA. Apr 2016.

Participation in Workshops and Conferences

- **ACM SIGMOD** Online
SIGMOD 2021 June 2021
- **Very Large Database** Online
VLDB 2020 June 2020
- **Very Large Database** Los Angeles, CA
VLDB 2019 May 2019
- **ACM SIGMOD** Houston, TX
SIGMOD/PODS 2018 May 2018
- **ACM SIGMOD/PODS** Chicago, IL
SIGMOD/PODS 2017 May 2017

- **1st Workshop on Data Management and End-to-End Machine Learning** Chicago, IL
DEEM 2017 May 2017
- **Center for Unstoppable Computing Research Summit** Chicago, IL
The University of Chicago March 2017
- **Quantum Computing Symposium** Argonne, IL
Argonne National Lab May 2016
- **6th Global Internet Symposium** San Francisco, CA
IEEE INFOCOM 2016 April 2016

Technical Skills

- Computer Science
 - Machine Learning, Deep Learning, Optimization, Parallel Programming, Database, Distributed Systems, Data Structure
- Programming Languages
 - Java, Scala, C/C++, Python, Go, Matlab, Javascript, HTML/CSS