



# Proceedings of the VLDB Endowment

Volume 17, No. 2 – October 2023

**Editors in Chief:**

Meihui Zhang and Cyrus Shahabi

**Associate Editors:**

Alkis Polyzotis, Amol Deshpande, Angela Bonifati, Ashraf Abounaga, Ashwin Machanavajjhala,  
Beng Chin Ooi, Boris Glavic, Ce Zhang, Divy Agrawal, Eric Lo, Fatma Ozcan, Guoliang Li,  
Jeffrey Xu Yu, Jian Pei, Jianliang Xu, Johannes Gehrke, K. Selçuk Candan, Kyuseok Shim, Li Xiong,  
Magdalena Balazinska, Matthias Boehm, Melanie Herschel, Michael Böhlen,  
Nikos Mamoulis, Pinar Tozun, Rachel Pottinger, Sharad Mehrotra, Surajit Chaudhuri, Tamer Özsu,  
Tien Tuan Anh Dinh, Walid Aref, Wei Wang, Xiaokui Xiao, Yanyan Shen, Yongxin Tong, Zi Huang

**Publication Editors:**

Ju Fan, Yang Cao, Xiaou Ding

PVLDB – Proceedings of the VLDB Endowment

Volume 17, No. 2, October 2023.

All papers published in this issue will be presented at the 50th International Conference on Very Large Data Bases, Guangzhou, China, 2024.

## Copyright 2023 VLDB Endowment

This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>. For any use beyond those covered by this license, obtain permission by emailing [info@vldb.org](mailto:info@vldb.org).

Volume 17, Number 2, October 2023

Pages i – vii and 79 - 263

ISSN 2150-8097

Available at: <http://www.pvldb.org> and <https://dl.acm.org/journal/pvldb>

## TABLE OF CONTENTS

### Front Matter

Copyright Notice .....	i
Table of Contents .....	ii
PVLDB Organization and Review Board – Vol. 17 .....	iv

### Research Papers

Cryptographically Secure Private Record Linkage Using Locality-Sensitive Hashing.....	79
<i>Ruidi Wei, Florian Kerschbaum</i>	
Language Models Enable Simple Systems for Generating Structured Views of Heterogeneous Data Lakes	92
<i>Simran Arora, Brandon Yang, Sabri Eyuboglu, Avanika Narayan, Andrew Hojel, Immanuel Trummer, Christopher Re</i>	
Query Refinement for Diversity Constraint Satisfaction.....	106
<i>Jinyang Li, Yuval Moskovitch, Julia Stoyanovich, H. V. Jagadish</i>	
ElasticNotebook: Enabling Live Migration for Computational Notebooks .....	119
<i>Zhaoheng Li, Pranav Gor, Rahul Prabhu, Hui Yu, Yuzhou Mao, Yongjoo Park</i>	
Breathing New Life into An Old Tree: Resolving Logging Dilemma of $B^+$ -tree on Modern Computational Storage Drives.....	134
<i>Kecheng Huang, Zhaoyan Shen, Zili Shao, Tong Zhang, Feng Chen</i>	
An Empirical Evaluation of Columnar Storage Formats .....	148
<i>Xinyu Zeng, Yulong Hui, Jiahong Shen, Andrew Pavlo, Wes Mckinney, Huanchen Zhang</i>	
Everest: GPU-Accelerated System For Mining Temporal Motifs .....	162
<i>Yichao Yuan, Haojie Ye, Sanketh Vedula, Wynn M Kaza, Nishil Talati</i>	
Billion-Scale Bipartite Graph Embedding: A Global-Local Induced Approach.....	175
<i>Xueyi Wu, Yuanyuan Xu, Wenjie Zhang, Ying Zhang</i>	
Utility-aware Payment Channel Network Rebalance .....	184
<i>Wangze Ni, Pengze Chen, Lei Chen, Peng Cheng, Chen Zhang, Xuemin Lin</i>	
ALECE: An Attention-based Learned Cardinality Estimator for SPJ Queries on Dynamic Workloads.....	197
<i>Pengfei Li, Wenqing Wei, Rong Zhu, Bolin Ding, Jingren Zhou, Hua Lu</i>	
Flash-LLM: Enabling Low-Cost and Highly-Efficient Large Generative Model Inference With Unstructured Sparsity .....	211
<i>Haojun Xia, Zhen Zheng, Yuchao Li, Donglin Zhuang, Zhongzhu Zhou, Xiafei Qiu, Yong Li, Wei Lin, Shuaiwen Leon Song</i>	
Confidential Consortium Framework: Secure Multiparty Applications with Confidentiality, Integrity, and High Availability.....	225
<i>Heidi Howard, Fritz Alder, Edward Ashton, Amaury Chamayou, Sylvan Clebsch, Manuel Costa, Antoine Delignat-Lavaud, Cedric Fournet, Andrew Jeffery, Matthew Kerner, Fotios Kounelis, Markus A. Kuppe, Julien Maffre, Mark Russinovich, Christoph M. Wintersteiger</i>	
VeLP: Vehicle Loading Plan Learning from Human Behavior in Nationwide Logistics System .....	241
<i>Sijing Duan, Feng Lyu, Xin Zhu, Yi Ding, Haotian Wang, Desheng Zhang, Xue Liu, Yaoxue Zhang, Ju Ren</i>	

Relational Query Synthesis  $\bowtie$  Decision Tree Learning.....250  
*Aaditya Naik, Aalok Thakkar, Adam Stein, Rajeev Alur, Mayur Naik*

## PVLDB ORGANIZATION AND REVIEW BOARD - Vol. 17

### Editors in Chief of PVLDB

Meihui Zhang (Beijing Institute of Technology)  
Cyrus Shahabi (University of Southern California)

### Associate Editors of PVLDB

Alkis Polyzotis (Databricks)  
Amol Deshpande (University of Maryland at College Park)  
Angela Bonifati (Lyon 1 University)  
Ashraf Aboulnaga (Qatar Computing Research Institute, HBKU)  
Ashwin Machanavajjhala (Duke)  
Beng Chin Ooi (NUS)  
Boris Glavic (Illinois Institute of Technology)  
Ce Zhang (ETH)  
Divy Agrawal (University of California, Santa Barbara)  
Eric Lo (Chinese University of Hong Kong)  
Fatma Ozcan (Google)  
Guoliang Li (Tsinghua University)  
Jeffrey Xu Yu (Chinese University of Hong Kong)  
Jian Pei (Simon Fraser University)  
Jianliang Xu (Hong Kong Baptist University)  
Johannes Gehrke (Microsoft)  
K. Selçuk Candan (Arizona State University)  
Kyuseok Shim (Seoul National University)  
Li Xiong (Emory University)  
Magdalena Balazinska (UW)  
Matthias Boehm (Technische Universität Berlin)  
Melanie Herschel (Universität Stuttgart)  
Michael Böhlen (University of Zurich)  
Nikos Mamoulis (University of Ioannina)  
Pinar Tozun (IT University of Copenhagen)  
Rachel Pottinger (Univ. of British Columbia)  
Sharad Mehrotra (U.C. Irvine)  
Surajit Chaudhuri (Microsoft)

Tamer Özsu (University of Waterloo)  
Tien Tuan Anh Dinh (Deakin University)  
Walid Aref (Purdue University)  
Wei Wang (ByteDance)  
Xiaokui Xiao (National University of Singapore)  
Yanyan Shen (Shanghai Jiao Tong University)  
Yongxin Tong (Beihang University)  
Zi Huang (University of Queensland)

### Publication Editors

Ju Fan (Renmin University of China)  
Yang Cao (Hokkaido University)  
Xiaou Ding (Harbin Institute of Technology)

### PVLDB Managing Editor

Wolfgang Lehner (Dresden University of Technology)

### PVLDB Advisory Board

Vanessa Braganholo (Universidade Federal Fluminense)  
Sourav S Bhowmick (Nanyang Technological University)  
Torsten Grust (University of Tuebingen)  
Xin Luna Dong (Facebook)  
Fatma Ozcan (Google)  
Lei Chen (Hong Kong University of S&T)  
Juliana Freire (New York University)  
Graham Cormode (University of Warwick)  
Divesh Srivastava (AT&T Labs-Research)  
Felix Naumann (HPI)  
Georgia Koutrika (Athena Research Center)  
Jun Yang (Duke University)  
Meihui Zhang (Beijing Institute of Technology)  
Cyrus Shahabi (University of Southern California)  
Nesime Tatbul (Intel Labs and MIT)  
Themis Palpanas (Universite Paris Cite)

## Review Board

Abolfazl Asudeh (University of Illinois Chicago)  
Aditya Parameswaran (University of California, Berkeley)  
Ahmed S. Abdelhamid (Purdue University)  
Ahmed Eldawy (University of California, Riverside)  
Ahmed El-Roby (Carleton University)  
Ahmed Mahmood (Google)  
Alberto Lerner (University of Fribourg, Switzerland)  
Alexander Thomson (Google)  
Amr Magdy (University of California Riverside)  
Andreas Züfle (Emory University)  
Angelos Christos Anadiotis (Oracle)  
Anja Gruenheid (Microsoft)  
Anthony Tung (National U. of Singapore)  
Anton Dignös (Free University of Bozen-Bolzano, Italy)  
Arijit Khan (Aalborg University)  
Avrilia Floratou (Microsoft)  
Baihua Zheng (Singapore Management University)  
Bailu Ding (Microsoft Research)  
Berthold Reinwald (IBM Research-Almaden)  
Bin Yang (East China Normal University)  
Bingsheng He (National University of Singapore)  
Bolin Ding (Data Analytics and Intelligence Lab, Alibaba Group)  
Brandon Haynes (Microsoft Gray Systems Lab)  
Chao Zhang (University of Waterloo)  
Cheng Long (Nanyang Technological University)  
Chengfei Liu (Swinburne University of Technology)  
Chengkai Li (The University of Texas at Arlington)  
Chengliang Chai (Beijing Institute of Technology)  
Chrysanthi Kosyfaki (University of Ioannina)  
Chunwei Liu (MIT)  
Cong Yan (Microsoft research)  
Daisy Zhe Wang (University of Florida)  
Dan Kifer (Pennsylvania State Univ., USA)  
Dan Lin (Vanderbilt University)  
Daniel Kang (UIUC)  
Demetrios Zeinalipour-Yazti (University of Cyprus)  
Dimitris Papadias (HKUST)  
Dong Deng (Rutgers University - New Brunswick)  
Dong Wen (University of New South Wales)  
Dong Xie (Penn State University)  
Dongxiang Zhang (Zhejiang University)  
Dumitrel Loghin (National University of Singapore)  
Egemen Tanin (University of Melbourne)  
El Kindi Rezig (Massachusetts Institute of Technology)  
Elena Ferrari (University of Insubria, Varese)  
Eser Kandogan (Megagon Labs)  
Essam Mansour (Concordia University)  
Fan Zhang (Guangzhou University)  
Fatemeh Nargesian (University of Rochester)  
Fei Chiang (McMaster University)  
Feng Zhang (Renmin University of China)  
Florin Rusu (UC Merced)  
Gabriel Ghinita (Hamad Bin Khalifa University)  
Gao Cong (Nanyang Technological University)  
George Fakas (Uppsala University)  
Haibo Hu (Hong Kong Polytechnic University)  
Holger Pirk (Imperial College)  
Hong Cheng (Chinese University of Hong Kong)  
Hongzhi Wang (Harbin Institute of Technology)  
Hua Lu (Roskilde University)  
Huanchen Zhang (Tsinghua University)  
Huiping Cao (New Mexico State University)  
Ibrahim Sabek (MIT)  
Ilaria Bartolini (University of Bologna)  
Jana Giceva (TU Munich)  
Jennie Rogers (Northwestern University)  
Jia Zou (Arizona State University)  
Jian Lou (Zhejiang University)  
Jiangshan Yu (Monash University)  
Jianguo Wang (Purdue University)  
Jiannan Wang (Simon Fraser University)  
Jianqiu Xu (Nanjing University of Aeronautics and Astronautics)  
Jianxin Li (Deakin University)  
Jieming Shi (The Hong Kong Polytechnic University)  
Jin Wang (Megagon Labs)  
Jinfei Liu (Zhejiang University)  
Johes Bater (Tufts University)  
John Liagouris (Boston University)  
Jonathan Goldstein (Microsoft)  
Ju Fan (Renmin University of China)  
Juhua Hu (University of Washington)  
Kai Wang (Shanghai Jiao Tong University)  
Kangfei Zhao (Beijing Institute of Technology)  
Karima Echihabi (Mohammed VI Polytechnic University)  
Katja Hose (TU Wien)  
Khuzaima Daudjee (University of Waterloo)  
Kyoungmin Kim (POSTECH)  
Lawrence Benson (HPI, University of Potsdam)  
Lei Chen (Hong Kong University of Science and Technology)  
Lei Zou (Peking University)  
Leong Hou U (University of Macau)  
Lin Ma (University of Michigan)  
Linyang Chu (McMaster University)  
Liyue Fan (UNC Charlotte)  
Lu Chen (Zhejiang University)  
Luigi Bellomarini (Banca d'Italia)  
Madelon Hulsebos (University of Amsterdam)  
Manolis Terrovitis (IMIS, Athena RC)  
Marco Patella (University of Bologna)  
Mario Nascimento (Northeastern University)  
Matteo Lissandrini (Aalborg University)  
Matthias Renz (University of Kiel)  
Michael Hay (Colgate University & Tumult Labs)  
mingjie tang (Ant Financial)  
Mirek Riedewald (Northeastern University)  
Mohamed S. Hassan (Google)  
Mohamed Mokbel (University of Minnesota - Twin Cities)  
Mohammad Javad Amiri (University of Pennsylvania)  
Mostafa Milani (The University of Western Ontario)  
Mourad OUZZANI (Qatar Computing Research Institute, HBKU)  
Nesime Tatbul (Intel Labs and MIT)  
Norman May (SAP SE)  
Oliver A Kennedy (University at Buffalo, SUNY)

Panagiotis Bouros (Johannes Gutenberg University Mainz)  
 Papotti Paolo (EURECOM)  
 Patrick Damme (Technische Universität Berlin)  
 Peng Peng (Hunan University)  
 Philippe Bonnet (IT Univ Copenhagen, Denmark)  
 Pinar Karagoz (METU, Turkey)  
 Prashant Pandey (University of Utah)  
 Primal Pappachan (Penn State University)  
 Qichen Wang (Hong Kong Baptist University)  
 Qing Liu (Zhejiang University)  
 Qun Chen (Northwestern Polytechnical University)  
 Renata Borovica-Gajic (University of Melbourne)  
 Rihan Hai (TU Delft)  
 Ritesh Ahuja (Oracle Labs)  
 Roger Zimmermann (NUS)  
 Ronghua Li (Beijing Institute of Technology)  
 Sai Wu (Zhejiang Univ)  
 Sanjay Krishnan (UChicago)  
 Senjuti Basu Roy (NJIT)  
 Seokki Lee (University of Cincinnati)  
 Shantanu Sharma (New Jersey Institute of Technology)  
 Shaofeng Cai (National University of Singapore)  
 Shaoxu Song (Tsinghua University)  
 Shuai Ma (Beihang University)  
 Shuang Hao (Beijing Jiaotong University)  
 Sibowang (The Chinese University of Hong Kong)  
 Stefania Dumbrava (ENSIIE)  
 Stefano Paraboschi (Universita' degli Studi di Bergamo)  
 Sujaya Maiyya (University of Waterloo)  
 Tarique Siddiqui (Microsoft Research)  
 Thanaa Ghanem (Metro State University)  
 Thang Dinh (VCU)  
 Themis Palpanas (Universite Paris Cite)  
 Thomas Neumann (TUM)  
 Tianhao Wang (University of Virginia)  
 Tianzheng Wang (Simon Fraser University)  
 Tieying Zhang (Bytedance)  
 Tristan Allard (Univ Rennes, CNRS, IRISA)  
 Umar Farooq Minhas (Apple)  
 Utku Sirin (Harvard University)  
 Viktor Leis (Technische Universität München)  
 Vincenzo Gulisano (Chalmers University of Technology)  
 Vraj Shah (IBM Research)  
 Wang-Chien Lee (Pennsylvania State University, USA)  
 WEI LU (Renmin University of China)

Wei Wang (Hong Kong University of Science and Technology (Guangzhou))  
 Wei-Shinn Ku (Auburn University)  
 Wenchao Zhou (Alibaba Group)  
 Wendy Hui Wang (Stevens Institute of Technology)  
 Xiang Lian (Kent State University)  
 Xiang Zhao (National University of Defence Technology)  
 Xiangyao Yu (University of Wisconsin-Madison)  
 Xiao Hu (Duke University)  
 Xiao Hu (University of Waterloo)  
 Xiaochun Yang (Northeastern University)  
 Xiaofang Zhou (The Hong Kong University of Science and Technology)  
 Xiaofei Zhang (University of Memphis)  
 Xiaohui Yu (York University)  
 Xiaoli Wang (Xiamen University)  
 Xin Huang (Hong Kong Baptist University)  
 Xin Wang (Tianjin University)  
 Xingquan Zhu (Florida Atlantic University)  
 Yanfeng Zhang (Northeastern University)  
 Yang Cao (Hokkaido University)  
 Yannis Chronis (Google)  
 Yao Lu (Microsoft Research)  
 Ye Yuan (Beijing Institute of Technology)  
 Yeye He (Microsoft Research)  
 Ying Zhang (University of Technology Sydney)  
 Yingxia Shao (BUPT)  
 Yu Yang (City University of Hong Kong)  
 Yuhao Zhang (University of California, San Diego)  
 Yuncheng Wu (National University of Singapore)  
 Yunjun Gao (Zhejiang University)  
 Yuval Moskovitch (Ben Gurion University)  
 Yuxiang Zeng (Beihang University)  
 Zhaojing Luo (National University of Singapore)  
 Zhengjie Miao (Duke University)  
 Zhichao Cao (Arizona State University)  
 Zhifeng Bao (RMIT University)  
 Zhiwei Zhang (Beijing Institute of Technology)  
 Zhongle Xie (Zhejiang University)  
 Zhuoyue Zhao (University at Buffalo - SUNY)  
 Ziawasch Abedjan (Leibniz Universität Hannover)  
 Ziliang Lai (Chinese University of Hong Kong)  
 Zimu Zhou (City University of Hong Kong)

## LETTER FROM THE EDITORS IN CHIEF

It is our pleasure to present the second issue of Volume 17 of PVLDB (Proceedings of the VLDB). PVLDB is dedicated to showcasing original research papers that encompass a wide spectrum of subjects within the realm of data and information management. Our coverage spans from fundamental theoretical principles and cutting-edge system architectures to innovative models, techniques, novel applications, and the comprehensive assessment and deployment of large-scale solutions. In our research track, we feature four equally significant categories of papers: (a) regular research, (b) scalable data science (SDS), (c) experiment, analysis & benchmark (EA&B), and (d) vision papers.

The second issue of PVLDB's Volume 17 includes 14 papers, spanning the topics of AI/ML and databases, data privacy and security, graph and network data, database engines, novel database architectures, data models and query languages, as well as ethical data management. Several topics stood out, the most popular ones in this issue: AI/ML and databases (4 papers), data privacy and security (3 papers), and graph and network Data (2 papers).

Out of the 14 papers, two papers are in the scalable data science category, one is in the experiment, analysis & benchmark category, and the rest are regular research papers. All 14 papers were accepted after revision.

PVLDB is committed to providing valuable and constructive feedback through a rigorous review process. All submissions undergo meticulous peer review by a team of accomplished Associate Editors and dedicated reviewers. Each paper receives comprehensive evaluation from a minimum of three reviewers, along with the oversight of an Associate Editor. During a three-week discussion phase, reviewers engage in a thorough exchange of perspectives, ultimately converging on a consensus, which is summarized in a meta-review. Some submissions may proceed to a revision phase, affording authors a three-month window to refine their work for subsequent review cycles.

This issue is the result of all the work put in by the authors as well as the great commitment and effort of our associate editors and reviewers as well as our proceedings chairs.

Meihui Zhang and Cyrus Shahabi  
Editors-in-Chief of PVLDB Vol. 17  
Program Chairs for VLDB 2024