

Rakan A. Alseghayer

6340 Abi Adh Dhahab
Al Mursalat, Riyadh 12461
Saudi Arabia

<https://ralseghayer.github.io>
ralseghayer@cs.pitt.edu
+966 555 456 016
<https://www.linkedin.com/in/rakan-alseghayer/>

EDUCATION

- **University of Pittsburgh** Pittsburgh, PA, USA
Ph.D. in Computer Science Aug. 2014 - Aug. 2023
Thesis Title: Optimizing Operators for Temporal and Spatiotemporal Data
Academic Advisor: Dr. Panos K. Chrysanthis (panos@cs.pitt.edu)
- **University of Pittsburgh** Pittsburgh, PA, USA
M.Sc. in Information Sciences; GPA: 3.98/4 May 2011 - Apr. 2013
Specialization: Information Security and Networking
- **University of Washington** Seattle, WA, USA
Educational Outreach Program Jan. 2010 - Mar. 2011
 - **Certificate:** Business for International Professionals.
 - **Certificate:** Fundamentals of Project Management.
 - **Certificate:** ELP Campus Intensive English Program (IEP).
- **King Saud University** Riyadh, KSA
B.Sc. in Computer Science; GPA: 4.68/5 Aug. 2004 - Jun. 2008

PROFILE

- **Innovative Researcher:** High capability in understanding holistically and in-details, breaking-down, and developing full plans to resolve research problems using scientific methodologies.
- **Problem Solver:** Strong ability to recognize and optimize inefficiencies in systems and work-flows through a systematic and automated approaches using technical and non-technical tools.
- **Data-centered Designer:** Strong strategic designing capabilities in tackling high-level problems and challenges by breaking them down into approachable components that are easily architected into data-intensive systems, while effectively measuring and managing the performance via quantifiable metrics.
- **Experienced Programmer:** Strong algorithmic and mathematical thinking in solving programming problems, as well as strong software engineering capabilities, such as knowledge in design patterns and software architecture.
- **Motivational Collaborator:** Thrive at helping teams and colleagues to succeed through applying social skills, embracing an outgoing personality, and utilizing experiences in mentoring and enabling co-workers.

RESEARCH PROJECTS

- **[C++11] Temporal Aggregation of Indoors Spatiotemporal Joins:** In this project, we develop a distributed framework for detecting indoor contacts between two individuals and measuring the individual risk of infection for respiratory transmitted diseases (e.g., COVID-19). The framework carries out the queries locally on the individual users' devices to protect their privacy, achieve scalability, and reduce energy consumption at their devices. Furthermore, we developed a novel in-memory structure, named *e-Raccoon* that optimizes temporal aggregation joins for trajectories. The *e-Raccoon* structure enables efficient trajectory joins with the duration of contacts cumulatively between an individual and a single other individual, while considering the exposure across other users.
- **[C++11] Detection of Correlated Temporal Streams:** In this project, we develop a real-time monitoring framework of large volumes of data streams that are produced at high velocity. Typically, pairs of most recently arrived data streams need to be correlated within a specified delay target in order for their analysis to lead to actionable results. We address this need by: (i) segmenting data streams into micro-batches; and (ii) leveraging incremental sliding window computation, priority scheduling, and caching techniques, to avoid unnecessary re-computations and I/O. Furthermore, we devise and evaluate exploration strategies that effectively steer the processing of data stream correlations based on the monitoring objective.
- **[JAVA] Environmentally Aware Urban Analytics:** Our goal in this project is to reduce energy consumption and reduce atmospheric pollution. To achieve that, data processing and decision-making need to be carried out at the network edge, specifically as close to the physical system as possible, where data is generated and used. This facilitates processing and generating results in real-time and make sure the data is not exposed to privacy and security risks. Thus, we leverage scheduling principles and statistical techniques in the context of two applications, namely aiming to reduce duty cycle of HVAC systems in smart homes and to mitigate road congestion in a smart cities. The first aim is approached through leveraging intelligent scheduling of the HVAC systems duty cycles in residential buildings. The second aim is achieved by introducing the concept of virtual bus lanes, that combines on demand creation of bus lanes in conjunction with dynamic control of traffic lights.

WORK EXPERIENCE

- **Researcher at the Advanced Data Management Technologies (ADMT) Lab** May 2022 - Aug. 2023
University of Pittsburgh, PA
 - **Tracking Horizontal Inequalities Across Dimensions to Forecast and Understand Instability (TRIAD) project:** 1) Containerized (Dockerized) Python applications. 2) Transferred Python modules to C++11 back-end servers.
 - **NIH - Causal MGM (Project ID 0136449):** 1) Developed modules in Python that incorporates R codes for a web interface. 2) Extracted visualizations across data pipelines. 3) Researched causality between features.
- **Teaching Assistants Mentor** Aug. 2022 - Dec. 2022
University of Pittsburgh
 - Provided one-to-one support to TAs to resolve daily issues.
 - Curated a reference of resources for TAs in the CS department.
 - Formed guides and procedures to manage the TA-instructor relationship and facilitate successful collaboration.
- **Project Coordinator** Jul. 2019 - Nov. 2019
Sae
 - Developed an algorithm to optimize the delivery of meals during lunch rush hour.
 - Developed and implemented an incentive-based module to captains (freelancers) to ensure high availability during lunch hour.
 - Created a complete business requirement specifications document for two food business models (mobileApp and webApp).
- **Lecturing Teaching Assistant** Aug. 2017 - Dec. 2022
University of Pittsburgh
 - **CS1555/2055 Database Management Systems (6 semesters):** Provides in-depth knowledge of database systems design through modeling and using existing DBMSs. The relational model is discussed in great detail, as well as the NoSQL model.
 - **CS1501 Algorithms & Data Structures 2 (2 semesters):** A programming intensive course that covers a broad range of the most commonly used algorithms, such as searching, encryption, compression, graphs, and dynamic programming.
 - **CS0011 Introduction to Computing for Scientists:** Covers how a computer works and how to write programs in Python in order to use the computer as a problem solving tool. Problems discussed are related to the natural sciences with an emphasis on computational biology.
- **Teaching Assistant** Aug. 2015 - Apr. 2023
University of Pittsburgh
 - **CS2550 Principles of Database Systems (3 semesters):** Covers in-depth knowledge of DBMSs design including detailed coverage of internal structures, physical storage models, concurrency control, recovery, query optimization, distributed databases, distributed concurrency control, and fault tolerance.
 - **CS1645/2045 Introduction to High Performance Computing (2 semesters):** Introduces the architecture of and software techniques for parallel and high performance computing systems, such as vector processing, shared-memory, and distributed-memory systems.
- **Lecturing Teaching Assistant** Apr. 2013 - Jul. 2014
King Saud University
 - **CSC311 Design and Analysis of Algorithms:** Covers mathematical essentials; sorting; space and time complexity theory; algorithm design methods, including greedy algorithms, divide and conquer, and dynamic programming; introduction to graph theory; and NP-completeness.
 - **CSC113 programming -2-:** Advanced concepts and topics such as relationships between classes, inheritance, polymorphism, abstract classes, error handling, interfaces, generics, and data structures (e.g., linked lists, stacks and queues).
 - **CSC215 Procedural Programming using C Language:** Introduces the procedural programming paradigm that covers a brief history of C, C primitive data types, variables and constants, operators (arithmetic operators, logical operators, etc.), control structures, procedures and parameter passing, user defined types, and pointers.
 - **CSC111 programming -1-:** Covers the basic concepts of Object Oriented programming approach such as abstraction and encapsulation principles, classes, objects, constructor concepts, information hiding principle and setters and getters, methods, message passing and overloading principle.

- **Associate Software Engineer, Systems Development, R&D Department**
Advanced Electronics Company Ltd. (AEC)

Oct. 2008 - Jul. 2009
Riyadh, KSA

- **Industrial Business Unit:** Developed parts of the Data Collection Unit (DCU) and the communication protocol (using TCP/IP) under the .Net environment for the project (ADDAD4).
- **Military Business Unit:** Developed a military encrypted data communication system for tactical radios.

SELECTED TECHNICAL PROJECTS

- **[JAVA] Distributed Systems – Simple Remote Procedure Call System:** Implemented a client, server, and a port-mapper components of an RPC system. We addressed issues related to parameter passing, binding, exception handling, call semantics, performance and data representation. We achieved server high availability and load balancing through replication and name resolution respectively.
- **[JAVA] Distributed Systems – MiniGoogle: Document Indexing and Querying:** We implemented a basic data-intensive application to index and search large documents. The goal is to design a simple search engine, referred to as tiny-Google, to retrieve documents relevant to simple search queries submitted by users. We did implement a replicated and reliable client/server model that consists of: the client, the server (has the indexing and querying masters), the helpers (for the mapping and reducing), and the name-server (for name resolution).
- **[JAVA] Distributed Systems and Networks – Simplified File Transfer Protocol System:** Addressed several issues in the design of FTP system including dealing with differences in file name conventions, text and data representation, and directory structure. Furthermore, the protocol ensured reliable transfer of files from one system to another. Designed and implemented the system in a layered fashion with a replicated and load balanced servers and name-servers. Built and error simulation module to introduce unreliability to the medium. Leveraged Go-Back-N as a sliding window protocol. Lastly, Conduct a thorough analysis of the performance of the system with multiple experiments. Those involved different packet error rates, different packet drop rates, and different re-transmission timeouts.
- **[JAVA] Principles of DBMSs – myTRC: my Transactional Row Column store DBMS:** Developed a Transactional Row Column store (myTRC) DBMS that efficiently supports concurrent execution of OLTP (i.e., transactions) and OLAP (i.e., aggregate queries) workloads. myTRC provides serializable and atomic access, it also provides the standard uncontrolled access to files. The memory component stores records in a row and column fashion to facilitates high performance retrieval based on the workload type.
- **[JAVA] Computer Architecture – Simulator for a modified PowerPc 604 and 620 Architectures:** The goal was to design, implement, and evaluate the performance of a dynamically scheduled processor. Implemented the simulator using Tomasulo algorithm with out of order execution, renaming registers, and reordering buffers, as well as a dynamic branch prediction using a target buffer.
- **[JAVA] Computer Architecture – Simulators for cache coherence protocols (MSI, MESI) in CMPs:** Built a CMP with dynamically configured cores, and each core has its own L1 private cache, and they all share a unified L2 cache. The protocols are writing back with invalidation. We implemented the simulator and evaluated the performance of each protocol.
- **[Python] Artificial Intelligence – Checkers Solver:** I developed a Checkers solver engine that competed against other engines. The engine was developed using minimax algorithm with alpha-beta pruning, and some cutoff techniques using some common heuristics, as well as some of my own developed heuristics, I was able to win the tournament.

SUMMARY OF SKILLS

- **Programming languages:** C++ (~40k LOC), JAVA (~20k LOC), Python (~25k LOC), SQL (~30k LOC).
- **Strong code debugging and profiling skills:** JetBrains IDEs (CLion, IntelliJ, PyCharm, DataGrip), Valgrind, cProfile.
- **DBMSs:** PostgreSQL, Oracle, MySQL, SQLite.
- **Programming libraries:** Scikit-learn, TensorFlow, NumPy, Scipy, Matplotlib.
- **Tools:** LaTeX, Git, Docker, Kubernetes.
- **Security:** Secured Java, Cryptography.
- **Computer networks:** gRPC, TCP/IP programming, Traffic and Packet Monitoring (Wireshark, IPTraf), Network performance analysis, Routing Protocols.
- **Outstanding writing skills:** Published in journals and conferences proceedings, also wrote technical reports and proposals.
- **Outstanding presentation skills:** Presented at scientific conferences, and gave regular talks at the department of computer science.

PUBLICATIONS & PRESENTATIONS

- R. Alseghayer, P. K. Chrysanthis, and C. Costa. “Duration Constrained Temporal Aggregation Query Processing for Contact Tracing in Indoor Spaces.” **[Under Review]**.
- R. Alseghayer, D. Petrov, P. K. Chrysanthis, M. Sharaf, and A. Labrinidis. “DCS: A Policy Framework for the Detection of Correlated Data Streams.” **[Lecture Notes in Business Information Processing, vol 337. Springer]**.
- B. Nixon, R. Alseghayer, C. Costa, B. Graybill, X. Zhang, and P. K. Chrysanthis. “Efficient Detection of COVID-19 Exposure Risk.” **[IEEE MDM ‘22]**.

- **Presented** – Rakan Alseghayer. “Racoon: Rapid Contact Tracing of Moving Objects Using Smart Indexes.” [IEEE MDM ‘21].
- D. Petrov, R. Alseghayer, P. K. Chrysanthis, and D. Mossé. “Smart Room-by-Room HVAC Scheduling for Residential Savings and Comfort.” [IGSC ‘19].
- D. Petrov, R. Alseghayer, and P. K. Chrysanthis. “Mitigating Congestion Using Environment Protective Dynamic Traffic Orchestration.” [MDASC ‘19 - Colocated with IEEE MDM ‘19].
- **Presented** – R. Alseghayer, P. K. Chrysanthis, and B. R. Childers. “Reproducibility Score for Computational Artifacts.” [MWS ‘19].
- D. Petrov, R. Alseghayer, D. Mossé, and P. K. Chrysanthis. “Data-Driven User-Aware HVAC Scheduling.” [IGSC ‘18].
- **Presented** – R. Alseghayer, D. Petrov, and P. K. Chrysanthis. “Strategies for Detection of Correlated Data Streams.” [ExploreDB ‘18 - Colocated with ACM SIGMOD ‘18].
- R. Alseghayer, D. Petrov, P. K. Chrysanthis, M. Sharaf, and A. Labrinidis. “Detection of Highly Correlated Live Data Streams.” [BIRTE ‘17 - Colocated with VLDB ‘17].
- **Presented** – D. Petrov, R. Alseghayer, M. Sharaf, P. K. Chrysanthis, and A. Labrinidis. “Interactive Exploration of Correlated Time Series.” [ExploreDB ‘17 - Colocated with ACM SIGMOD ‘17].

SERVICE & MEMBERSHIPS

- **Grand Awards Judge – Embedded Systems Track:** The Regeneron International Science and Engineering Fair (ISEF 2023).
- **Website Management & Online Arrangements:** The International Workshop on Self-Managing Database Systems (SMDB ‘23).
- **Committee Member:** Diversity and Inclusion (D&I) compliance committee in The 16th ACM International Conference on Distributed and Event-based Systems (ACM DEBS ‘22).
- **Student Volunteer:** The International Workshop on Self-Managing Database Systems (SMDB ‘21, SMDB ‘22).
- **External Reviewer:** The International Conference on Very Large Data Bases (VLDB ‘17, ‘21, ‘22).
- **External Reviewer:** The International Conference on Database Systems for Advanced Applications (DASFAA ‘21).
- **External Reviewer:** The annual IEEE International Conference on Data Engineering (IEEE ICDE ‘17, ‘19, ‘20, ‘21).
- **External Reviewer:** The ACM Special Interest Group on Management of Data (ACM SIGMOD ‘17).
- **External Reviewer:** The IEEE International Conference on Mobile Data Management (IEEE MDM ‘18, ‘19).
- **External Reviewer:** The Conference on Information and Knowledge Management (ACM CIKM ‘19).
- **External Reviewer:** The ACM/IEEE Conference on Internet of Things Design and Implementation (IoTDI ‘17).

AWARDS, SCHOLARSHIPS & HONORS

- Recipient of the student scholarship for the cybersecurity event Black Hat (2022).
- Recipient of the Diversity and Inclusion Award at the Ph.D. forum of the 22nd IEEE International Conference on Mobile Data Management (MDM 2021).
- Recipient of the People’s Choice of Best Pitch Video at the 22nd IEEE International Conference on Mobile Data Management (MDM 2021).
- PITT CS Department Orrin E. and Margaret M. Taulbee Award runner-up (2021).
- Recipient of the student travel grant for the 11th International Workshop on Real-Time Business Intelligence & Analytics (BIRTE 2018).
- Recipient of the King Saud University scholarship for a Ph.D. in Computer Science (2014 - 2020).
- Recipient of the Saudi Arabian Cultural Mission Scholarship for a M.Sc. in Information Science (2010 - 2012).
- Undergrad Second Class Honors from King Saud University (2008).

LANGUAGES

- **Arabic:** Native.
- **English:** Bilingual Proficiency.
- **Spanish:** Beginner.

REFERENCES

- **Dr. Panos K. Chrysanthis**
Professor, Department of Computer Science, University of Pittsburgh, Pittsburgh, PA, USA
 - **Email:** panos@cs.pitt.edu
 - **Website:** <https://panos.cs.pitt.edu>
- **Dr. Daniel Petrov**
Product Manager Senior Staff, Juniper Networks, Sunnyvale, CA, USA
 - **Email:** dpetrov@juniper.net
 - **Website:** <https://www.linkedin.com/in/danielpetrov>
- **Dr. Constantinos Costa (Konstantinos Kosta)**
Co-Founder & Chief Executive Officer (CEO), Rinnoco LTD, Limassol, Cyprus
 - **Email:** costa.c@rinnoco.com
 - **Website:** <https://costadb.com>
- **Dr. Tariq Alturkistani**
Co-Founder & Chief Executive Officer (CEO), Sae, Jeddah, KSA
 - **Email:** tariq@sae.sa
 - **Website:** <https://www.linkedin.com/in/alturkestani/>