Muhammed Fatih Balin

Ph.D. Student · HPC and ML Practitioner

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"Strive always to excel in virtue and truth."

Areas of Interest

- Large scale deep learning on graphs via graph convolutional networks and its variants
- Parallel algorithms for CPUs and GPUs, distributed algorithms for clusters of computers
- Applying deep learning to discrete optimization problems

Education

Georgia Institute of Technology *Atlanta, GA, USA*

Ph.D in Computational Science and Engineering *Aug. 2019 - PRESENT*

- Focusing on High Performance Computing and Machine Learning advised by Umit V. Catalyurek and Le Song.

Bogazici University *Istanbul, Turkey*

B.S. in Computer Engineering and Mathematics, (Double Major), GPA: 3.94/4.00 *Sep. 2015 - Jun 2019*

- Rank of 1 in department, 3 in faculty among 400 engineering students.

Columbia University in the City of New York *New York, NY, USA*

Non-degree Exchange Student in Computer Science, GPA: 4.07/4.33 *Jan. 2018 - May. 2018*

- Rank of 4 among 250 students in a graduate level theory-heavy machine learning course.

Honors & Awards

2019	**Summa Cum Laude**, Bogazici University	*Istanbul, Turkey*
2018	**Dean's List**, Columbia University in the City of New York	*New York, NY, USA*
2017	**57th place**, Google Hashcode	*Online*
2017	**7th place**, ACM-ICPC SEERC Coding Competition	*Vinnytsia, Ukraine*
2016	**2nd place**, Istanbul Technical University - IEEE Coding Competition	*Istanbul, Turkey*

Publications

Under Review

- **M. F. Balin**, X. An, A. Yasar, U. V. Catalyurek, "A Novel Subgradient-based Method for d-Dimensional Rectilinear Partitioning", arXiv:2110.08688.
- **M. F. Balin**, K. Sancak, U. V. Catalyurek, "MG-GCN: Scalable Multi-GPU GCN Training Framework", arXiv:2110.08688.

Published

- A. Yasar, **M. F. Balin**, X. An, K. Sancak, U. V. Catalyurek, "On Symmetric Rectilinear Matrix Partitioning", Journal of Experimental Algorithmics (JEA).
- M. Y. Ozkaya, **M. F. Balin**, A. Pinar, U. V. Catalyurek, "A scalable graph generation algorithm to sample over a given shell distribution", IEEE International Parallel and Distributed Processing Symposium Workshops (IPDPSW), Workshop on Graphs, Architectures, Programming, and Learning, May 2020.
- **M. F. Balin**, A. Abid, J. Zou, "Concrete Autoencoders for Differentiable Feature Selection and Reconstruction", International Conference on Machine Learning (ICML), June 2019.

Talks

International Conference on Machine Learning 2019 *Los Angeles, CA, USA*

Presenter for Concrete Autoencoders for Differentiable Feature Selection and Reconstruction *Jun. 2019*

- Presented our paper on unsupervised feature selection in the unsupervised learning session

Research Experience

TDAlab, Georgia Institute of Technology *Atlanta, GA, USA*

Graduate Research Associate *Aug. 2019 - PRESENT*

- Currently interested in fast & parallel training methods for Graph Neural Networks and its variants, one paper submitted to MLSYS 2022
- Proposed subgradient optimization for rectilinear partitioning of sparse matrices and point datasets, arXiv version at arXiv:
- Devised and implemented a shared memory code and a hybrid version with MPI using C++11 threads, lock-free data structures and fine-grained parallelism to generate random graphs given a k-core structure, accepted at IPDPSW 2020
- Implemented a 2D sparse prefix sum data structure using persistent Binary Indexed Trees to speed up the prefix sum queries in matrix partitioning algorithms, proposed sparsification idea to make queries much faster and proposed more efficient heuristics for the symmetric rectilinear partitioning problem, accepted at JEA 2021

Bogazici University & Stanford University *Istanbul, Turkey & Stanford, CA, USA*

Undergraduate Remote Collaborator *Sep. 2018 - Mar. 2019*

- Introduced a new scalable unsupervised feature selection algorithm called Concrete Autoencoders based on the Concrete Distribution and Autoencoders.
- Published and presented our work at ICML 2019 as a first author, paper is available at arXiv:1901.09346, talk is available on slideslive.

Creative Machines Lab, Columbia University *New York, NY, USA*

Undergraduate Research Assistant *Jan. 2018 - May. 2018*

- Devised and implemented a topology optimization algorithm in C++ via simulated annealing and a simulation approach.
- Implemented a visualization tool in C++ and OpenGL for the optimization and simulation algorithm.

Teaching Experience

Georgia Institute of Technology *Atlanta, GA, USA*

Teaching Assistant for CSE6740 - Computational Data Analytics *Aug. 2020 - Dec. 2020*

- Held office hours, graded assignments and prepared exams.

Georgia Institute of Technology *Atlanta, GA, USA*

Teaching Assistantships for CSE6010 - Computational Problem Solving *Aug. 2019 - Dec. 2019*

- Gave 3 of the lectures, held office hours and graded programming assignments.

TUBITAK *Afyon, Turkey*

Advisor & Instructor for Olympiads in Informatics *Sep. 2017 & Sep 2018*

- Gave lectures on discrete mathematics, advanced data structures and algorithms.
- Mentored high school students in better preparing for the Olympiads in Informatics.

Work Experience

Icron Technologies *Istanbul, Turkey*

Research Engineering Intern *Jul. 2017 - Aug. 2017*

- Learned about applications of optimization techniques such as mixed integer programming in industry.
- Learned Icron, a fully functional visual programming language developed and being used at Icron Technologies.

Baykar Technologies *Istanbul, Turkey*

Software Engineering Intern *Jul. 2016 - Sep. 2016*

- Implemented a library using suffix arrays to handle search queries efficiently for a GUI application.
- Implemented a tool to convert simple C header and source files to C#.
- Implemented a line of sight algorithm to determine where a Unmanned Aerial Vehicle can go without losing line of contact with a receiver.

Baykar Technologies *Istanbul, Turkey*

Software Engineering Intern *Jun. 2015 - Aug. 2015*

- Worked on a GUI application that monitors and controls an Unmanned Aerial Vehicle's state to add new features and fix bugs.
- Found bottlenecks in code processing post-flight data to get a 50x of speedup.

Skills

- **Spoken Languages:** English (TOEFL 111), German (Abitur), Turkish
- **Technology:** C++17, MPI, Python, Tensorflow, Pytorch, DGL, OpenCV, Java, Matlab, SyCL, CUDA, Parallel Programming
- **Certificates:** Entrepreneurship Seminar Series - BIC Angels, Istanbul, Turkey, 2016