ZUBAIR NAWAZ

Assistant Professor
PUCIT
Appointed Since: 02 Oct 1, 2011
On TTS: 01 Oct 2012
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EDUCATION

PhD in Computer Engineering Delft University of Technology, NL 2005 – 2011

- **Research focus:** Compiler optimization, Reconfigurable Computing, High performance computing, Instruction level parallelism, Loop level parallelism
- **Thesis Title:** Recursive Variable Expansion: A transformation for Reconfigurable Computing.

MS Computer Science Lahore University of Management Sciences, PK 1999 – 2002

- **Thesis Title:** Secure Auction Service

BS Mechanical Engineering G.I.K. Institute of Engineering Sciences & Technology, PK 1993 – 1997

- **Thesis Title:** Valve Dynamics of an IC Engine

APPOINTMENTS

Assistant Professor	Punjab University College of IT, University of the Punjab, Pakistan	Oct 2011 – to date
Postdoc	SESAME - Synchrotron-light for Experimental Science and Applications in the Middle East, Jordan	Aug 2013 – June 2014
Postdoc	Computer Engineering Lab, Delft University of Technology, The Netherlands	Jan 2011 – Aug 2011
Research Assistant	Computer Engineering Lab, Delft University of Technology, The Netherlands	Nov 2005 – Jan 2011
Assistant Professor	Punjab University College of IT, University of the Punjab, Pakistan	Jul 2005 – Oct 2011
Lecturer	Punjab University College of IT, University of the Punjab, Pakistan	May 2002 – Jun 2005
Assistant Engineer	Piping design department, DESCON Engineering Limited, Pakistan	Jul 1997 – Aug 1999
Application Programmer	Softwork International, Lahore, Pakistan	Jun 1993 – Oct 1993

RESEARCH EXPERIENCE

SESAME | SYNCHROTRON-LIGHT FOR EXPERIMENTAL SCIENCE AND APPLICATIONS IN THE MIDDLE EAST, Jordan

Group: Scientific
Project: EU FP7, LINKSCEEM

- Published 1 impact factor papers in collaboration with ESRF
- Optimized and improved pyFAI, an application for powder diffraction using OpenCL.
- Implemented fixed-radius near neighbor problem for XRF Beamline in C++ (https://github.com/znawaz).
- Ported Pelegant software on IMAN1, Jordan Supercomputer based on 2260 PS3 game consoles.
- Procured the HPC system for SESAME.

Punjab University College of IT, University of the Punjab, Pakistan

Group: Compiler and High Performance Lab
Project: Parallelizing Java Compiler for multi/many-cores

- Proposed a near optimal polynomial time algorithm which partitions and maps the applications on multi/many-cores based on both the execution and communication cost.

- Developed a simulator which takes a partitioned a standard task graph (STG) and gives the overall execution time on multi/many-cores.
- Developed a source to source compiler named Rubus that takes a Java code and partitions on CPU and GPU code and then converts the GPU code into a parallel OpenCL code completely automatically.

Group: Data Science, Machine Learning and NLP lab
Project: NLP for local languages

- Developed a hybrid stemmer for Punjabi Shahmukhi script
- Sentiment Analysis in Urdu language
- Poet Identification from Urdu poetry
- Urdu Name entity recognition using deep learning

Project: Healthcare System for Pakistan

- Automatic detection of breast cancer from mammogram
- Risk assessment forecast for cardio-vascular disease

Project: Safe city project

- Automated accident detection from safe city cameras in live stream

Project: Financial Market analysis

- Stock market prediction

Computer Engineering Lab, Delft University of Technology, NL
Group: Delft Workbench
Project: hArtes
Advisor: Prof. Stamatis Vassiliadis, Prof. Koen Bertels

- Proposed a transformation called *Recursive Variable Expansion* (RVE) suitable for FPGAs. When it is applied to certain classes of problems extracts more parallelism than conventional techniques.
- Devised an automatic pipelining algorithm for some RVE compliant problems. It showed comparable performance to hand optimized implementation when applied to DCT.
- Developed my own small compiler that takes a C program applies RVE to it, make an optimal pipeline and outputs the relevant VHDL code.
- Proposed an RVE based framework for a large class of Dynamic Programming problems. We accelerated up to 3.01x at the cost of 1.68x more area consumption.
- Accelerated Smith-Waterman (SW) more than the widely used dataflow implementation.
- Proposed a parallel FPGA design for SW traceback that computes the alignment after once scanning through the whole database. Moreover, it also addresses the memory bandwidth issue that arises due to such designs.
- Evaluated different C to HDL compilers using a set of kernels.

Lahore University of Management Sciences
Advisor: Prof. Haroon A. Babri

- Proposed a secure sealed bid auction service based on primitive cryptographic constructs like encryption, signature and hashing. It fulfilled the security requirements like data confidentiality, message origin authentication, message integrity, transaction authentication and non-repudiation.
- Developed the protocol using Java, Java Servlets and JCE library.

INTERNATIONAL COLLABORATION

European Synchrotron Research Facility (ESRF), Grenoble, France

- Published one impact factor journal
- Working with Data Analysis group on the automatic detection of Debye-Sherrer rings produced in XRAY diffraction.

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LOCAL COLLABORATIONS

Cancer Care, Lahore, Pakistan

- Automatic detection of breast cancer from mammogram

TEACHING EXPERIENCE

MS level courses

Advanced Machine Learning — Spring 2018

Neural Network, Stochastic Gradient Descent, Deep Neural network, Convolutional Neural network, VGG net, Resnet, Inception net, Transfer learning, RNN, LSTM, LSTM applications, Language model. Implementation of all the networks in Keras.

High Performance Computing — Once a year since Since 2012

- Major course contents: GPU architecture, Parallel programming using CUDA, parallel communication pattern gather, scatter, stencil, Global and local memory, optimization using shared memory, CUDA streams, profiling and debugging the parallel program. Optimizing code on GPUs.
- Supervised 10 HPC projects based on GPGPU using CUDA.

Data Science — Once a year Since 2016

- Major course contents: Python basics, Pandas, Data wrangling using Python, web-scrapping, Visualizations, Bokeh, statistical analysis, Natt Silver Election predictions, Linear Regression, Logistic Regression, Lasso, Neural Networks, KNN, Naïve-Bayes analysis, SVM, Decision Tree, Random Forest, ensembles, Feature Selection, Feature reduction using PCA, hyperparameter tuning, Introduction to Hadoop and MapReduce.
- Supervised various 15 Data Science related projects

Advanced Computer Architecture — Fall 2012, Fall 2013, Fall 2014

- Instructing a class of 40 students
- Major course contents: RISC architecture, pipelining, superscalar, Instruction level parallelism, Multicores, GPUs, FPGAs, Memory and Caches,

Advanced Algorithms — Fall 2011

- Introduced and designed the graduate course curriculum.
- Major contents: Amortized Analysis, FFT, Disjoints sets, Fibonacci heaps, Network Flow Algorithms, Number theoretic algorithms, NP problems.

Compiler Optimizations — Fall 2012

- Class of 10 students
- Major course contents: Machine Independent Optimizations, Dataflow analysis, Instruction level parallelism, loop level parallelism, task level parallelism, locality analysis, unimodular transformations, polyhedral transformations, Interprocedural optimizations

BS courses

Data Science using Python — Spring 2018

Computer Architecture — Spring 2014

Analysis of Algorithms — Once a year Since 2011

Electronic Commerce, Payment and Security systems — Sep 2004 – Feb 2005

- Introduced and designed the graduate course curriculum.
- Set up an open source certification authority.
- Major contents: basic number theoretic concepts, RSA, Discrete logarithm problem, digital signature, Digital Certificates, SSL, SET, 3D Secure, iKP, Millicent, NetBill, Electronic Cash, Dematerialized checks, Security of Integrated Circuit Cards

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PUBLICATIONS

Impact Factor Journals

S. Kanwal, S. Nawaz, M. K. Malik and Z. Nawaz, "**A Review of Text-Based Recommendation Systems**," in IEEE Access, vol. 9, pp. 31638-31661, 2021, doi: 10.1109/ACCESS.2021.3059312.

N. Shafi, F. Bukhari, W. Iqbal, K. M. Almustafa, M. Asif, and Z. Nawaz, **Cleft prediction before birth using deep neural network**, Health Inform. J., pp. 1–18, Apr. 2020

M.T. Ahmad, M.K. Malik, K. Shahzad, F. Aslam, A. Iqbal, Z. Nawaz, F. Bukhari, **Named Entity Recognition and Classification for Punjabi Shahmukhi**. ACM Trans. Asian Low-Resource. Lang. Inform. Process. (TALLIP) 2020, 19, 1–13.

A.H. Chaudhary, F. Bukhari, W. Iqbal, Z. Nawaz, MK Malik, **Laparoscopic Training Exercises Using HTC VIVE**, INTELLIGENT AUTOMATION AND SOFT COMPUTING, 2020, 26, 53-59

S. Kanwal, K. Malik, K. Shahzad, F. Aslam and Z. Nawaz, **Urdu Named Entity Recognition: Corpus Generation and Deep Learning Applications**, ACM Transactions on Asian and Low-Resource Language Information Processing (TALLIP) 19(1) (2019), 8.

S. Shahzad, N. Khan, Z. Nawaz, C. Ferrero, **Automatic Debye-Scherrer Elliptical Ring Extraction via a Computer Vision Approach,** (2018). J. Synchrotron Rad. 25, https://doi.org/10.1107/S1600577518000425, Impact factor: 2.186

M. Adnan , F. Aslam, Z. Nawaz, S. M. Sarwar, **Rubus: A compiler for seamless and extensible parallelism,** (2017), Plos One, 12(12), Impact factor: 2.806

G. Ashiotis, A. Deschildre, **Z. Nawaz,** , J.P. Wright, D. Karkoulis, F.E. Picca, & J. Kieffer, **The Fast Azimuthal Integration Python library**, (2015). J. Appl. Cryst. 48, 510-519, Impact factor: 2.57

HEC Recognized Journals

A. Mateen, M. K. Malik, **Z. Nawaz**, H.M. Danish, M. H. Siddiqui, Q. Abbas, **A Hybrid stemmer of Punjabi Shahmukhi Script,** IJCSNS, (2017), VOL.17 No.8

A. Rafique, M. K. Malik, Z. Nawaz, F. Bukhari, and AH Jalbani, **Sentiment Analysis for Roman Urdu**, Mehran University Research Journal of Engineering & Technology Research Journal, (2018)

N. Tariq, I. Ejaz, M. K. Malik, Z. Nawaz, F. Bukhari,. **Identification of Urdu Ghazal poets using SVM,** Mehran University Research Journal Of Engineering & Technology, IJCSNS, (2019) vol. 38 No. 4, 935–944

International conferences

Z. Nawaz, M. Nadeem, H. v. Someren, K.L.M. Bertels, **A parallel FPGA design of the Smith-Waterman traceback**, proceedings of International Conference on Field-Programmable Technology 2010, Beijing, China, December 2010.

Z. Nawaz, H. Sumbul, K.L.M. Bertels, **Fast Smith-Waterman hardware implementation**, International Parallel and Distributed Processing Symposium, Atlanta, USA, April 2010.

T. Abdullah, K.L.M. Bertels, L.O. Alima**, Z. Nawaz, Effect of the Degree of Neighborhood on Resource Discovery in Ad Hoc Grids,** Proceedings of the International conference on Architecture of Computing Systems (ARCS), Hannover, Germany, February 2010

Z. Nawaz, T. P. Stefanov, K.L.M. Bertels, **Efficient hardware generation for dynamic programming problems**, proceedings of International Conference on Field-Programmable Technology 2009, Sydney, Australia, December 2009.

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Z. Nawaz, T. Marconi, T. P. Stefanov, K.L.M. Bertels, **Flexible Pipelining Design for Recursive Variable Expansion**, International Parallel and Distributed Processing Symposium, Rome, Italy, May 2009.

L Hasan, Z. Al-Ars, **Z. Nawaz**, K.L.M. Bertels, **Hardware Implementation of the Smith-Waterman Algorithm Using Recursive Variable Expansion**, Proceedings of 3rd International Design and Test Workshop IDT08, Monastir, Tunisia, December 2008.

Z. Nawaz, M. Shabbir, Z. Al-Ars, K.L.M. Bertels, **Acceleration of Smith-Waterman Using Recursive Variable Expansion**, 11th Euromicro Conference on Digital System Design (DSD-2008), pp. 915-922, Parma, Italy, September 2008.

Z. Nawaz, O.S. Dragomir, T. Marconi, E. Moscu Panainte, K.L.M. Bertels, S. Vassiliadis, **Recursive Variable Expansion: A Loop Transformation for Reconfigurable Systems**, proceedings of International Conference on Field-Programmable Technology 2007, Kokurakita, Kitakyushu, Japan, December 2007.

TRAININGS

- Hands on training on pyHST and pyFAI, ESRF, Grenoble, France (Oct '13)
- Summer School on Models for Embedded Signal Processing Systems, The Netherlands (Aug '10)
- Advanced Computer Architecture by Yale Patt (Sept '10)
- Advanced Computer Architecture and Compilation for Embedded Systems, Spain (July '09)
- Algorithms for Advanced Processor Architectures, Denmark (June '08)
- Introduction to Cosy compiler (May '06)

STUDENT SUPERVISION

PhD Student

PhD Thesis Submitted

- Saadia Shahzad – "Automatic Debye Sherrer Ring Extraction"

Synopsis defended

- Safia Kanwal - "Urdu news recommendation engine"
- Hina Gul – "Mental illness evaluation from social media

Synopsis in progress

- Muhammad Shoaib Hanif - "Stock Market Prediction"

Masters Students

Completed

1. Asad Raza Usmani: "Compiler Optimizations for Recursive Variable Expansion Technique", 2011-2014
2. Sarwan Dar: "A Greedy Task Partitioning algorithm for homogeneous multiprocessor system", 2012 – 2014
3. Sharjeel Afzal: "Parallelizing JAVA Compiler for High Performance", 2012 – 2014
4. Adnan Amin: "Rubus: A Compiler for Seamless and Extensible Parallelism", 2013-2014
5. Hamid Tahir: "Semi-Automated Tool for Parallel Languages", 2012 – 2014
6. Abdul Manan Khan: "Parallel Computing of NEOTEC/RSD"- 2015-2016
7. Ahtesham Quraish: "Automatic detection of breast cancer from mammogram"
8. Nazish Ashfaq: "Stock Market Prediction"
9. Shahyar Tariq: "Product review Analysis"
10. Sophia Shahid: "Product Price Prediction of an online store"
11. Waqar Mumtaz: "A Fast Approach Towards Image Compression"

AWARDS / PROFESSIONAL AND PUBLIC SERVICES

- **CUDA Teaching Center Award 2014**, comprising 1 Tesla K40, 5 Titan black and teaching assistant funding worth more than $10000.
- **CUDA Teaching Renewal 2016,** 1 Tesla Titan X
- **Best poster award,** Conference on Scientific Computing, Dec 2013 organized by PRACE and LinkSCEEM.
- **Awarded** with HEC Overseas PhD Scholarship, got 15th position from among 2500 candidates.
- **Reviewer**

  - Conferences & Journal: IEEE Transactions on VLSI systems, ACM TECS, ASAP ’11, ASAP ’10, ICCD ‘10, ARC ‘10, DATE ‘09, FPL ‘08, SAMOS ‘08, RAW ‘08, Euromicro Journal of Systems Architecture ’07, DATE ‘07, FPL ‘07, SAMOS ‘07, ICS ‘07
- **Organizer and Speaker** of workshop **Data Science in Practice** in Sept. 2017 and March 2018
- **Submission chair**
  - Administered the submissions of SAMOS ‘09
- **Member**
  - IEEE, ACM
- **Member PRAC**