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# MUHAMMAD BILAL

## SUMMARY

Ph.D. in Computer Science with extensive experience in data mining, predictive modeling and simulation of complex systems. Strengths include strong demonstration of analytical thinking and attention to details, and excellent interpersonal, communication and leadership skills.

## EDUCATION

October 2011	<b>University of Bradford</b> PhD, School of Computing, Informatics, and Media	Bradford, United Kingdom
July 2015	<b>University of California Los Angeles</b> Entrepreneurship for Science, Medicine and Technology	Los Angeles, United States
November 2007	<b>Birmingham City University</b> Master in Computer Science (Pervasive computing)	Birmingham, United Kingdom
February 2006	<b>COMSATS University of Information Technology</b> Master in Computer Science	Pakistan
February 2003	<b>University of Punjab</b> Bachelors in Science (Mathematics, Physics)	Pakistan

## TECHNICAL SKILLS

<b>Programming:</b>	R, MATLAB, Python, C, C++, C#, Java (Web development: HTML, PHP, JavaScript, AngularJS, knockoutJS, d3.js, Bootstrap)
<b>Machine Learning/Data mining:</b>	Bayesian Networks, self-organizing maps, hierarchical clustering, regression/classification, support vector machines, multidimensional scaling, decision trees (forests), association rule mining, neural networks
<b>High performance computation: RDMS &amp; server application development:</b>	Rocks cluster, Sun Grid Engine, Ganglia MySQL, NoSQL (Mongo), PostgreSQL, JDBC, Apache, Tomcat, DHCP, DNS

## WORK EXPERIENCE

- Sept 2013- Present **Center for Environmental Implications of Nanotechnology (CEIN)** Los Angeles, CA  
*Assistant Researcher (Jan. 2017 - present), Research Scholar (Sept. 2013 - Jan. 2017) at UCLA*
- Lead a team of data specialists and researchers in developing and validating an online decision support system consisting of various machine learning/data mining tools such as bayesian networks (BNs), hierarchical clustering, decision trees, self organizing maps (SOMs), principle component analysis, and multicriteria decision analysis for assessing the potential environmental impact of ENMs. The systems allow query/access (MySQL) by external software using custom designed application programming interfaces (API)
  - Prepare to market and commercialize advanced machine learning tools for government and private sector organizations
  - Maintain a high performance computational cluster using rocks cluster and sun grid engine, with 22 nodes, 240 cpus, and 115tb of storage; perform hardware diagnostics and troubleshooting
  - Conduct web based first tier screening of the potential environmental impact of enms making use of Dempster Shafer theory on the knowledge transformed in tree structure
  - Conduct case studies using developed models/approaches to demonstrate their performance and applicability domains
  - Design and implement integrated computational tools as client server based web applications, which includes web-based advanced user interface, parameters database, data visualization and model solvers using html, php, java, r, javascript, mysql, and c++. Develop application programming interface to allow query/access of model and simulation tools by external software components
  - Write for academic journals, conduct and participate in international workshops and presentations for cein. Authored and co-authored 15 publications (5 published, 4 ready for submission, 2 under review, 4 in preparation). Delivered more than 10 oral and poster presentations in various scientific conferences and meetings.

June 2012 - Sept 2013      **University of Leeds, School of Computing**      Leeds, United Kingdom  
*Research Fellow*

- Constructed a multi-sensor apparatus for underground data collection in collaboration with a multidisciplinary team
- Used AI techniques such as Unsupervised Learning and Markov Chain Monte Carlo (MCMC) methods to construct the most probable map for underground buried utilities.
- Partnered with peer institutions for data collection and joint research initiatives
- Hosted and organized symposiums for project partners to present findings

July 2013      **British Broadcasting Corporation (BBC)**      Bradford, United Kingdom  
*Visiting lecturer at BBC*

- Prepared and delivered lectures on internet security and protocols
- Conducted hands-on exercises on cryptographic techniques for secure network communications

Mar 2011 - Aug 2012      **Metricell**      Horsham, United Kingdom  
*Mobile application developer at private analytical company focused on enhancing mobile service*

- Developed a mobile application that pinpointed service area problems to drive necessary investment by network operators
- Facilitated detailed analytical recommendations between Metricell and mobile service providers

Feb 2010 - May 2012      **University of Bradford, School of Computing, Informatics and Media**      Bradford, United Kingdom  
*Associate Lecturer of Computer Science*

Responsible for preparing the curriculum, laboratory exercises for undergraduate and postgraduate level computing courses. The courses included internet security and protocols, computer communications and networks, mobile applications, and computer programming. I was mainly involved in

- The research and design of inclusive curriculum.
- Preparing coursework and assessments and assessing students based on their performance.
- Maintaining an online feedback system and providing feedback on coursework/homework/dissertations.
- Providing mentoring, advice and support to students.
- Implementing university research projects such as student coursework repository (score) and engineering portal and publishing the systems.
- Preparing students progress reports and appraisals for senior managers.
- Applying for internal and external grants. Internal funded grants included score and edt projects ([www.edtprojects.brad.ac.uk](http://www.edtprojects.brad.ac.uk)). The external grants for which i have worked include csa for global rfid-related activities and standardization (casagras2 - <http://www.iot-casagras.org/>) and climber (later withdrawn from this project due to the move to the university of leeds).

Sep 2010 - May 2011      **University of Bradford, School of Health Studies**      Bradford, United Kingdom  
*Web Developer for coursework allocation and feedback management system*

- Developed an online student coursework repository for interactive feedback to students
- Created a centralized database for storage and processing of confidential data
- Organized training sessions for faculty and staff to utilize the repository and database

## OTHER PROFESSIONAL EXPERIENCE

**Web Developer - CASAGRAS2**      09/01/2010 - 11/01/2010

*University of Bradford, Bradford, United Kingdom*

Worked as a Web Developer for the European FP7 project CASAGRAS2 in which I was responsible for the design and implementation of the CASAGRAS2 website in Drupal.

**Mobile Application Developer**      05/01/2010 - 10/01/2010  
*University of Bradford, Bradford, United Kingdom*

Developed a child monitoring system for child care using Bluetooth technology in mobile phones (Symbian OS). The system uses one server which detects and keeps track of devices in range and more than one client. The server notifies the user in case if the client moves out of its range

## Web Developer - E-portal

09/01/2010 - 11/01/2010

*University of Bradford, Bradford, United Kingdom*

Worked on the development and maintenance of university project portal for administration, staff, and students of school of Engineering, Design and Technology ([www.edtprojects.brad.ac.uk](http://www.edtprojects.brad.ac.uk)). The e-portal is capable of record management and control of department of engineering, design and technology, in which the project allocation, selection, and marking help improve the learning and teaching practices.

## NOTABLE SOFTWARE AND PROGRAMMING EXPERIENCE

- Developed and currently maintaining web based environmental impact assessment platform for potential use by regulatory agencies, manufacturers, and researchers
- Developed a software for generating the most probable maps of buried underground utilities using Bayesian Mapping model
- Designed a remote control that read inputs from a user's eyes to drive movement of a wheelchair to facilitate convenient and safe movement for the end user
- Conducted simulations for the exposure assessment of ENMs using mechanistic modeling approaches. The simulations were designed using design of experiment approach (central composite design). Developed online tool as an intelligent query system using machine learning approaches for prediction on ENMs exposure scenarios.
- Developed a mobile application for public surveillance (Java/Android based application). This project is capable of recording real time video using an IP based camera connected to server that is responsible to provide the live streaming to a mobile device based on Android mobile operating system. The motion and camera orientation can be controlled by the remote mobile device for the detection of movements in the live video stream.
- Developed a video surveillance system for object detection using pattern matching techniques. The aim of the system was to develop a video detector that could detect a suspected/intended object using cameras and record the movement of the object in the surveillance area.
- Developed simulations for vehicle to vehicle communication to support safe driving

## PROJECTS

**Rapid assessment of Multimedia Environmental Distribution of Nanomaterials:** A BN model was developed to enable rapid assessment of the environmental multimedia mass distribution of ENMs utilizing mechanistic models for the estimation of emissions and multimedia environmental distribution of ENMs. The BN is capable of providing reasonable real time estimates of ENMs concentrations based on the data for wide ranges of parameters. BN model is suited for "what if" first tier analyses to provide estimations of potential exposure concentrations, impact of ENMs release rates and various other related parameters. BN also provides the causal-effect relationships between the parameters and resulting ENM concentrations in order to visually investigate their variations and their impact on ENMs concentrations. The modeling framework has been implemented as a web-based modeling system, which assists users in rapidly assessing ENMs exposure concentrations by specifying relevant ENMs properties, geographical and meteorological parameters (i.e., regions, temperature, wind speed, rain, etc.), and source emissions, as well as visualizing the results. (Model Solver: Netica, R; Web application: PHP, JavaScript)

**Modeling Life Cycle Environmental Assessment for the Release of Nanomaterials:** A generalized web-based modeling platform of the life cycle environmental assessment for the release of ENMs (LearNano) was developed to estimate the ENMs release rates to the environment by tracking the mass of ENM from production, through the various technical compartments (i.e., waste water treatment, septic systems, waste incineration), to the eventual ENM release to different environmental compartments. (Model solver: Java, C++, PHP; Web application: PHP, JavaScript, And MySQL)

**Environmental Impact Assessment of Engineered Nanomaterials:** A data-driven modeling platform based on BN was developed for qualitatively and quantitatively assessing the potential environmental impact of ENMs. BN structure was designed based on domain knowledge of toxicological and transport behaviors of ENMs, relating their physicochemical properties, exposure concentration, and relevant hazard information. The conditional probability tables for the BN was populated using data on ENM toxicity and exposure levels. The modeling platform was deployed as a web application via custom designed user interface adhering to standard web application principles (i.e., MVC), which enables rapid online expert survey and elicitation. (Model solver: R, Java, C++, PHP; Web application: PHP, JavaScript, and MySQL)

**NanoDatabank: A Flexible Database Management System for Nanomaterials:** NanoDatabank is a flexible data management system that provides for classification and storage of various ENMs relevant data types. NanoDatabank currently contains data sets on more than about 400 ENM types, and more than 1000 investigations regarding ENM toxicity (including metal oxides, quantum dots, CNTs and more), F&T and ENM characterization. NanoDatabank supports nanoinformatics tools/simulators by providing (a) accessibility to data

sets by various simulators and data processing tools, (b) ability to upload raw data and perform various data processing functions, and (c) an intelligent datasets query system. A unique feature of the NanoDatabank is a dynamically built taxonomy/ontology and storage of ENM information/data with various data access/security levels to allow and promote safe data sharing and storage. In addition, reliability (i.e. clarity regarding exactly what is being reported and trustworthiness/reproducibility) and relevance (i.e. usefulness for a particular purpose) of information is stored in NanoDatabank as metadata along with compressed associated information. To address the issues of data sharing and integration, NanoDatabank uses a range of data converters/utilities to integrate the information among computational tools as part of nanoinformatics platform (nanoinfo.org) for various scenarios such as life cycle assessment of the release of nanomaterials, multimedia exposure analysis of ENMs, QSARs and data driven models for the evaluation of toxicity of ENMs.

(Development environment: PHP, JavaScript, MySQL, KnockoutJS)

**Conditional dependence and association rule mining of zebrafish phenotypes:** An analytical framework was created for the assessment of correlation of zebrafish phenotypes based on experimental data from nanomaterial biological interaction (NBI) knowledgebase. Using 7 different types of ENMs (metal, metal oxide, cellulose, dendrimers, carbon, semiconductor, polymeric) as a model system, a range of clustering techniques (i.e., SOM, hierarchical) and association rule mining techniques were developed to assess the relationships and interdependence of zebrafish phenotypes.

## MAJOR PUBLICATIONS/WORKING PAPERS

- *E. Oh, R. Liu, A. Nel, K. Gemill, M. Bilal, Y. Cohen & I. Medintz*, "Meta-analysis of cellular toxicity for cadmium-containing quantum dots", *Nature Nanotechnology*, doi: 10.1038/nnano.2015.338
- *Liu R, Rallo R, Bilal M, Cohen Y*, Quantitative structure-activity relationships for cellular uptake of surface-modified nanoparticles, *Combinatorial Chemistry & High Throughput Screening*, 2015. 18(4): 365-375
- *Bilal, M., Liu, H., Liu, R., & Cohen, Y.* Bayesian Network as Support Tool for Rapid Query of the Environmental Multimedia Distribution of Nanomaterials, *Nanoscale*, 2017, doi: 10.1039/C6NR08583K.
- *M. Bilal, H. Liu, R. Liu, Y. Cohen*, "A Bayesian Network decision support tool for exploring curated quantum dots toxicity data" (Ready for submission).
- *Bilal, M., Muggleton, J., Rustighi, E., Jenks, H., Pennock, S. R., Atkins, P. R. & Cohn, A.*, "Inferring the most probable maps of buried underground utilities using Bayesian mapping model", (accepted), (November 2017) *Journal of Applied Geophysics*.
- *John Thompson, Anditya Rahardianto, Soomin Kim, Muhammad Bilal, Richard Breckenridge, Yoram Cohen.* Real-time direct detection of silica scaling on RO membranes. *Journal of Membrane Science, Volume 528, 15 April 2017, Pages 346-358, ISSN 0376-7388.*
- *Romero, M., Godwin, H., Bilal, M., Cohen, Y.* Needs and Challenges for Assessing the Environmental Impacts of Engineered Nanomaterials (ENMs), *Beilstein J. Nanotechnol.* 2017, 8, 989–1014.
- *H. Liu, M. Bilal, A. Lazareva, A. Keller & Y. Cohen*, "Simulation tool for assessing the release and environmental distribution of nanomaterials", *Beilstein J. Nanotechnol.* 2015, 6, 938–951.
- *Khan, W., Darren, A., Kuru, K. & Bilal, M.* The Flight Guardian: Autonomous Flight Safety Improvement by Monitoring Aircraft Cockpit Instruments. (accepted), (2017) *Journal of Aerospace Information Systems*.
- *Bilal, M., Church, P., Liu R., Liu H., & Cohen, Y.* NanoDatabank: A Flexible Database Management System for Nanomaterials (Ready for submission).
- *Bilal, M., Liu, R., Harper, S., & Cohen, Y.* Assessment of embryonic zebrafish (EZ) toxicity of diverse nanomaterials based on meta-analysis. *Nanotoxicology* (ready for submission).
- *M. Bilal, P.M.L. Chan, W. Khan*, "Cooperative Network for Emergency Communications: Fair Distribution of Reward among Players based on their Marginal Contribution", *Journal of Selected Areas in Telecommunications (JSAT)*, 2013.
- *W. Khan, P. Jiang, P. Chan, M. Bilal*, "A Creative Application of Wavelet Transform and Kalman Filter for Children Proof-reading and Continuous Speech Tracking in Online Stories and TV Programs", *Inderscience publishers*, 2014.

## CONFERENCE PROCEEDINGS

- *Liu, H. H.; Bilal, M., Lazareva, A., Keller, A., Cohen, Y.*, Regional multimedia distribution of nanomaterials and associated exposures: A software platform. 2014 IEEE International Conference on Bioinformatics and Biomedicine. 2014, 10.
- *M. Bilal, I. Awan, S. Mockford*, "A Unique Global Mobile Network Service Tracker and User Centric Data Analyzer", in IEEE BWCCA 2012, Canada, November. 2012.

- **M. Bilal**, A. Yar, S. Mockford, W. Khan, & I. Awan, " Tracesaver: A Tool for Network Service Improvement and Personalized Analysis of User Centric Statistics ", in PCOGlobal 2012, USA, August. 2012.
- **M. Bilal**, M. O. Hussain, P.M.L. Chan "A Reception Based Node Selection Protocol for Multi-hop Routing in Vehicular Ad-hoc Networks", in Int. conf. IEEE IUCC, Liverpool, UK, 25-27 June 2012.
- **M. Bilal**, P.M.L. Chan, F.S. Meddings, A. Konstadopoulou. "Learner Centered E-Assessment with a Universal Marking Scheme". IEEE Int.Conf. Teaching & Learning. ICTL. Penang, Malaysia, Nov, 2011.
- **M. Bilal**, P.M.L. Chan "Student Coursework Repository (SCORE): The hub for online assessment and learner support repository". Conf. Teaching & Learning. LTA. Bradford, United Kingdom, April, 2011.
- **M. Bilal**, P.M.L. Chan, "A Coalitional Incentive Scheme based on Game Theory for Multi-hop Routing in Vehicular Ad hoc Networks", IEEE 6th int. Conf. FCST 2011, Changsha, China Nov 2011.
- **M. Bilal**, P. M. L. Chan & P. Pillai, "A Fastest Multi-Hop Routing Scheme for Information Dissemination in Vehicular Communication Systems", IEEE Conf. SoftCom, Split, Croatia, 2010,
- **M. Bilal**, P.M.L. Chan, & P. Pillai, "A Fastest-Vehicle Multi-Hop Routing in Vehicular Ad hoc Networks", IEEE Conf. CIT – 2010, Bradford, UK 2010.
- C., Evans & **M. Bilal**, "Developing a WAP application for Mobile Retail Customers", ICPCA - 2007, in 2<sup>nd</sup> International Conference on Pervasive Computing and Applications, Birmingham, UK, 2007.

## CONFERENCE PRESENTATIONS

- "Association Rule Mining for Assessing the Relationships Among Biological Responses of Embryonic Zebrafish", American Institute of Chemical Engineers (AIChE), Annual Meeting, October 31, 2017, Minneapolis, MN.
- "Flexible database management system for nanoinformatics research and data integration", American Chemical Society (ACS) National Meeting, April 2-6, 2017, San Francisco.
- "Nanoinformatics platform for environmental impact assessment of engineered nanomaterials", American Chemical Society (ACS) National Meeting, April 2-6, 2017, San Francisco.
- "ToxNano: A Toolkit for Toxicity Data Analysis of Engineered Nanomaterials", Gordon Research Conference, June 21-26, 2015, WestDover, VT.
- "Development of a Framework for Environmental Impact Assessment of Engineered Nanomaterials (ENMs)". Gordon Research Conference, June 21-26, 2015, WestDover, VT.
- "Probabilistic Assessment of the Potential Environmental Impact of Engineered Nanomaterials", Nanoinformatics Workshop, Jan 26-28, 2015, Arlington, VA.
- "Nanoinfo.org: An integrated Nanoinformatics Web Portal", Nanoinformatics Workshop, Jan. 28, 2015, Arlington, VA
- "Probabilistic Nanoinformatics Modeling Platform for Assessing the Potential Environmental Impact of Engineered Nanomaterials", American Chemical Society (ACS) National Meeting, August 11, 2014, San Francisco, CA.
- "Nanoinformatics platform for assessing the potential environmental distribution and exposure levels of engineered nanomaterials (ENMs)", American Chemical Society National Meeting, Aug. 11, 2014, San Francisco, CA
- "Nanoinformatics Platform for Environmental Impact Assessment of Nanomaterials", UCLA Tech Forum, 2014, Los Angeles, CA.
- "Regional multimedia distribution of nanomaterials and associated exposures: A software platform", IEEE International Conference on Bioinformatics and Biomedicine, Nov. 2, 2014, Belfast, UK
- "A Reception Based Node Selection Protocol for Multi-hop Routing in Vehicular Ad-hoc Networks", in Int. conf. IEEE IUCC, Liverpool, UK, 25-27 June 2012.
- "Learner Centered E-Assessment with a Universal Marking Scheme". IEEE Int.Conf. Teaching & Learning. ICTL. Penang, Malaysia, Nov, 2011.
- "A Fastest-Vehicle Multi-Hop Routing in Vehicular Ad hoc Networks", IEEE Conf. CIT – 2010, Bradford, UK 2010.