

# Manal Helal

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## RESEARCH & TEACHING INTERESTS

My research interests are in Parallel and distributed Algorithms for various Big Data and high dimensional (Tensor structures) analytics problems. The application domains I worked on previously are Bioinformatics, Health Records and Medical datasets, engineering patents datasets, social networks analytics, pharmaceutical and financial datasets. I have experiences researching, teaching and applying various algorithms in Artificial Intelligence and Pattern Matching and Optimisation. I seek an academic position in the mentioned fields, whether research focused or mixed teaching and research loads. My previous teaching experience are in Parallel Algorithms and distributed systems, Graph Theory, Data Structures and Algorithms, GIS, Networking, AI & Pattern Recognition, Web Development, Various Programming Courses from introductory to advanced and Theoretical Concepts, Graphics, and Database Management.

## Education

**PhD of Computer Science and Engineering**, University of New South Wales, **March 2010**

**Masters of Computer Science**, the American University in Cairo (AUC), **January 2001**

**Bachelor of Computer Science**, the American University in Cairo (AUC), **January 1995**

## PUBLICATIONS

- Helal, Manal E., "Patent Mining by Extracting Functional Analysis Information Modelled As Graph Structure: A Patent Knowledge-base Collaborative Building Approach", submitted and waiting for review results.
- Helal, Manal E., and Hussein Hamed Ghouz. 2017. "On Signal Reconstruction Algorithms and Speedup Opportunities." In National Radio Scientific Conference (NSRC) Alexandria, Egypt, 13-16 March 2017, pp (186-96). IEEE. doi:10.1109/NRSC.2017.7893503.
- Abdel Azeem, B., Helal, M., Performance Evaluation of Checkpoint/Restart Techniques for MPI Applications on Amazon Cloud, In Proceedings of the 9th INFOS 2014 International Conference on Informatics and Systems, Cairo, Egypt, 15-17, December 2014., Accepted the 25<sup>th</sup> of October 2014.
- Helal, M.E., Kong, F., Chen, S.C.A., Zhou, F., Dwyer, D.E., Potter, J., Sintchenko, V. Linear normalized hash function for clustering gene sequences and identifying reference sequences from multiple sequence alignments, *Microbial Informatics and Experimentation*, 2(2), January 2012.
- Helal, M.E., Kong, F., Chen, S.C.A., Bain, M., Christen, R., Sintchenko, V. Defining reference sequences for *Nocardia* species by similarity and clustering analyses of 16S rRNA gene sequence data, *PLoS ONE*, 6(6), June 2011.
- Helal, M., Sintchenko, V. Dynamic programming algorithms for discovery of antibiotic resistance in microbial genomes. *Electronic Journal of Health Informatics* 2011; 6(1):e10. ISSN: 1446-4381.
- Helal, M.E., Indexing And Partitioning Schemes For Distributed Tensor Computing With Application To Multiple Sequence Alignment - in fulfillment of the degree of Doctor of Philosophy, University of New South Wales, Computer Science and Engineering School, Faculty of Engineering, August 2009.
- Helal, M., Mullin, L., Potter, J., Sintchenko, V. Search Space Reduction Technique for Distributed Multiple Sequence Alignment. In Proceedings of the 6th IFIP International Conference on Network and Parallel Computing (NPC 2009). Gold Coast, Queensland, Australia, October 2009.
- Helal, M., Sintchenko, V. Dynamic programming algorithms for discovery of antibiotic resistance in microbial genomes, In Proceedings of the Health Informatics Conference (HIC-09). - Canberra, Australia, August 2009.
- Helal, M., El-Gindy, H., Mullin, L., Gaeta, B. Parallelizing Optimal Multiple Sequence Alignment by Dynamic Programming. In Proceedings of the International Symposium on Advances in Parallel and Distributed Computing Techniques (APDCT-08) held in conjunction with 2008 IEEE International Symposium on Parallel

and Distributed Processing with Applications (ISPA-08). Sydney, Australia, December 2008. pp. 669-674. ISBN: 978-0- 7695-3471-8.

- Helal M., El-Gindy, H., Gaeta, G., Sintchenko, V. High Performance Multiple Sequence Alignment Algorithms for Comparison of Microbial Genomes. In proceedings of the 19th International Conference on Genome Informatics - GIW 2008. - Gold Coast, 2008.
- Helal, M., Mullin, L.M., Gaeta, B., El-Gindy, H. Multiple sequence alignment using massively parallel mathematics of arrays. In proceedings of the International Conference on High Performance Computing, Networking and Communication Systems (HPCNCS- 07), Orlando, FL. USA, 2007. pp. 120-7.
- Helal, M., Mullin, L., El-Gindy, H., Gaeta, B. Optimal Parallel Solution for Multiple Sequence Alignment Using Mathematics of Arrays. Poster presentation presented at Bioinformatics Australia 2006 "Connecting Australian Bioinformatics" 21-22 November 2006, Sydney Convention and Exhibition Centre, Darling Harbour, Sydney, NSW, November 2006.
- Helal, M., Mullin, L., Gaeta, B., El-Gindy, H. Multiple Sequence Alignment Using Massively Parallel Mathematics of Arrays. Poster presentation presented at BioInfoSummer 2005 - ICE-EM Summer Symposium in Bioinformatics, The Australian National University, Canberra, Australia, November 2005.
- Helal, M., Mullin, L., Gaeta, B., El-Gindy, H. Multiple Sequence Alignment Using Massively Parallel Mathematics of Arrays. Poster presentation presented at the APAC Conference and Exhibition on Advanced Computing, Grid Applications and eResearch , Royal Pines Resort, Gold Coast, Australia, September 2005.
- Sameh, M. A., Helal, M.E., Dimension and Shape Invariant Array Programming: The Implementation and the Application", Poster in the ISCA 17th Int'l conference on Computer Automation and Their Applications (CATA-2002), April 4-6, 2002, San Francisco, USA
- Sameh, M. A., Helal, M.E., Dimension and Shape Invariant Array Programming: The Implementation and the Application Recent Advances in Simulation, Computational Methods, and Soft Computing, Book, Electrical and Computer Engineering Series, Editor: Nokos Mastorakis, WSEAS Press, 2002
- Sameh, M. A., Helal, M.E., Dimension and Shape Invariant Programming - The Implementation and the Application, Proceedings of the 3rd WSEAS Symposium on Mathematical Methods and Computational Techniques in Electrical Engineering, Athens, Greece, December 29-31, 2001.
- Helal, M.E., Dimension and Shape Invariant Programming - The Implementation and the Application- in partial fulfilment of the degree of Masters of Science, American University in Cairo, Computer Science Department, School of Science and Engineering, January 2001.

## ACADEMIC PROJECTS AND RESEARCHES

### Current Interests:

- Patent Mining producing various results. Developed a graphical modelling of functional analysis diagrams extracted from patent document in a software (PatMine) ©, developed as an add-in for Solid-Works with huge potential to add more machine learning and big data analytics gradually. This wiki for the project is maintained in: <http://patmine.manalhelal.com>
- Classify Arabic Music genres " Maqam" using HMM, neural networks, SVM and Naive Bayes.
- Building graphical models for diagnosing diseases using genes' interactions network analysis
- Classify MRI brain images into normal, tumour, stroke and dementia classes using neural networks and other classification methods.
- Making sense of big data analysis, using Multivariate Analysis methods such as Regression Analysis, Factor Analysis, Survival Analysis, Clustering, Classification, Bayesian Analysis and Probabilistic Models. Other data analysis methods are of interest such as visualisation methods, data linkage methods, high dimensional analysis and reduction.
- Compare and benchmark Parallel signal reconstruction algorithms for compression sensing
- Distributed Machine Learning Algorithms for various application domains using tools such as Apache Mahout.
- Using Ontologies across Languages by using a Language lexicon.
- Automatic ontology building from unstructured Data using tools such as Apache UIMA.

- Tensor (Hyper-cube) partitioning on various parallel and distributed processing architectures such as GPGPUs, multicore, clusters, clouds, and map/reduce framework.
- Roads design optimisation to maximise traffic flow.

#### **Past Research Projects – Small Experiment**

- Fault tolerance tools in legacy distributed applications and their performance when migrating to the cloud.

#### **Previous Projects:**

- Microbial genomes clustering: the project is conducted in CIDM – University of Sydney. Various Clustering algorithms and tools have been used to verify the GenBank submission species assignment. The objectives of the study is to identify a clustering procedural steps and the suitable tools, the visualization of the data and clusters, the recommendation of clusters centroids (golden references or representatives), and optimal number of clusters. This work produced a new clustering method that outperformed classical machine learning algorithms for the DNA sequence alignment and distance matrix data sets.
- PhD Thesis "Indexing and Partitioning Schemes for Distributed Tensor Computing with Application to Multiple Sequence Alignment" - This thesis investigates indexing and partitioning schemes for high dimensional scientific computational problems. Building on the foundation offered by Mathematics of Arrays (MoA) for tensor-based computation, the ultimate contribution of the thesis is a unified generic partitioning scheme that works invariant of the dataset dimension and shape. The experimentation of the thesis was focused on the Multiple Sequence Alignment (MSA) Dynamic Programming Algorithm Parallelization. The research developed an optimized parallel generic and scalable MSA tool, and a new search space reduction technique.
- Master's Thesis "Dimension and Shape Invariant Programming - The Implementation and the Application" - The thesis implemented in C++ (as an imperative programming languages) the Mathematics of Arrays (MOA) Constructs, which is a programming paradigm that is invariant of dimension and shape. Arrays dimension and shape are entered at run time, and performance linearly scale with the array contents invariant of the data dimensionality and shape. The theory was tested through image and video processing as 2-dimension and 3-dimension applications, and it was proven feasible. Parallel processing factors are examined in this new paradigm, and hardware implementation was conducted also (using the Renoir tool). The new paradigm is promising, but still requires lots of experimentation and applications.
- Graduation Project: "Cairo Maps". It is a Geographic Information System (GIS) fir Cairo Main Streets and tourists attractive site. It contained a map editor interfacing with a digitizer, a graph model data structures, a shortest route routine, and media clips for the main tourists' sites.

#### **Gradation Projects Supervised:**

##### **Spring 2015**

- Pre-Processing of MRI Images to create a training data set for classification using state of the art image processing and classification techniques.

##### **Fall 2015**

- Stream processing analysis using Apache Storm framework on local machines and on the cloud.
- Migrating a high dimensional database to Oracle OLAP server to create and OLAP cube and produce high dimensional queries and reports.

##### **Fall 2013**

- Green Energy GIS decision support System, for demand/supply analysis, siting optimisation, environmental impact analysis, future prediction, and simulation tools (time permits all will be attempted, and can be completed and extended in future projects). Building an interoperable cloud storage that spans the free services from the various providers:
- Dropbox, Google drive, Amazon drive, MS sky drive, Ubuntu one... etc. Future ideas can extend to provide more apps for the various devices (IOS, Android, windows, mac, Linux) to access the virtual drive as one. Future ideas can provide automatic backup and restore, replication for fault tolerance.

##### **Spring 2013**

- GIS crime mapping tool using Regression Analysis and Clustering.

- Web Crawling Internet contents to answer queries, using keyword mapping to particular topics, and image matching using CamFind.

#### Fall 2012

- Big data processing using Apache Mahout and Hadoop.
- Automated class attendance using face recognition with openCV- over MS Kinect device.

#### Other Projects:

- A Learning Knowledge base system, with simple natural language parser, using Delphi on Windows environment for a Graduate course "Advanced Artificial Intelligence". It was divided into two parts, a learning module, and a solution finder module. The first Module learns by being fed by natural language (English) Statements that the module parses, analyses, and stores its keywords specifying relations between them in a knowledge base, sorted by area of knowledge. Then, using the second module, a question can be asked (in English again), and gets analysed, to search for the answers, matching its keywords with those stored in the Knowledge base from the first module, then forms the complete sentence of the answer to the user.
- A Distributed Crazy 8 game using C on UNIX platform, for Graduate Course "Advanced Distributed Systems".
- A phone dealer using C++ on Windows, for Graduate Course "Advanced Software Engineering".
- Shape Recognition project using Matlab, for Graduate Course "Digital Image Processing & Pattern Recognition".
- Implemented an ALU (Arithmetic Logic Unit) using VHDL (VHSIC hardware description language), for Undergraduate Course "Computer Architecture".

### AWARDS & PARTICIPATIONS

- Awarded NSF/IEEE-TCPP Curriculum Initiative Early Adopter Program to adopt undergraduate curriculum to include PDC (Parallel & Distributed Computing). (<http://www.cs.gsu.edu/~tcpp/curriculum/?q=node/21329/>)
- Invited by the Massachusetts General Hospital (MGH) in May 2010 to present my work to Professor Brian Seed laboratory research team in the Centre for Computational and Integrative Biology (Health Sciences and technology, Harvard Medical School).
- Received the Branko Cesnik Awards for Best Student Scientific Paper for the paper titled "Dynamic programming algorithms for discovery of antibiotic resistance in microbial genomes" published in Proceedings of the Health Informatics Conference (HIC-09) - Canberra, Australia, August 2009. Sponsored by the NSF (National Science Foundation, Arlington, Virginia, USA) to participate in the "Future Directions in Tensor-Based Computation and Modeling" workshop held in February 20-21, 2009.
- Invited by the Australian Institute of Health Innovation (AIHI), University of New South Wales, for a seminar with the title "Multiple Sequence Alignment for Clustering and Classification of DNA Sequences" on the 22nd of June, 2010.
- Invited by the Centre for Health Informatics (CHI), Faculty of Medicine, University of New South Wales, to participate in the CHI Winter Workshop on Next Generation Decision Support Systems on the 8 August 2008.
- Awarded the UPA (University Post-graduate Award) scholarship for the PhD study at the University of New South Wales, Sydney, Australia.
- Sponsored by APAC (Australian Partnership for Advanced Computing) now the NCI (National Computation Infrastructure), to:
  - Attend the Bioinformatics summer school in December 2005, in ANU (Australian National University, Canberra, Australia).
  - Attend the APAC Conference & Exhibition for Advanced Computing, Grid Applications & eResearch, October 8-12, 2007, Rendezvous Observation City Hotel, Perth, Western Australia.
  - Use the High Performance Machines since 2005 till now.
- Sponsored by AC3 to attend the APAC Conference and Exhibition on Advanced Computing, Grid Applications and eResearch, September 26 - 29, 2005, Royal Pines Resort, Gold Coast, Australia. Awarded a one semester scholarship for the undergraduate study in the American University in Cairo (AUC) for participating in the

Music group and receiving the 1st position for three consecutive years in the national universities competitions in Egypt.

- Achieved the Ideal Student in the 9th Grade over the school and one of the top ten in the Heliopolis Educational District in Cairo, Egypt.
- Won the 8th position in a championship for the Karate girls players under 10 years of age from all governments in the Arab republic of Egypt.
- Received several Certificates of Merit, some for volunteer activities and others for school competitions and marks.

## Teaching Experiences

- **Spring 2016**

- Distributed & Parallel System – (Graduate)
- Advanced Programming Languages – (Graduate)
- Object Oriented Programming
- Introduction to Programming

- **Fall 2015**

- Introduction to Computers
- Introduction to Programming
- Object Oriented Programming
- Distributed Systems
- Pattern Recognition (Graduate Course)

- **Spring 2015**

- Introduction to Programming
- System Programming

- **Fall 2014**

- Introduction to Computers
- Programming Applications
- Data Structures
- Computer Graphics
- System Programming
- Pattern Recognition (Graduate Course)

- **Spring 2014**

- Object Oriented Programming
- Advanced Programming Applications

- Computer Algorithms
- Computational Theory
- **Fall 2013**
  - Object Oriented Programming
  - Advanced Programming Applications
  - Computer Graphics
- **Spring 2013**
  - Object Oriented Programming
  - Advanced Programming Applications
  - Geographic Information Systems
  - Algorithmic Graph Theory (Graduate Course)
- **Fall 2012**
  - Object Oriented Programming
  - Advanced Programming Applications
  - Software Components (Design Patterns)
  - Parallel Programming & Algorithms (Graduate Course)
- **Fall 2011**
  - Algorithms & Data Structures
- **Spring 2011**
  - Parallel Programming & Algorithms

## Employment History

### **College of Engineering and Technology, Arab Academy for Science, Technology, and Maritime Transport (AASTMT) , Cairo/Egypt - Assistant Professor September 2012 - Present**

- Teaching Undergraduate computer science and engineering courses such as Computer Algorithms, Computational Theory, Graphics, Various Programming Courses, GIS, and Design Patterns.
- Teaching Postgraduate courses such as Parallel Algorithms, Graph Theory, and Pattern Recognition.
- Supervising Graduation Projects and postgraduate research projects.
- Conducting my research projects independently and jointly with other teams.

**Part time Research Assistant, ARC funded project, APAI linkage grant with EICU, for FBE, UNSW, Sydney/Australia. April 2012 – August 2012**

**College of Computer and Information Systems, Umm Al Qura University, Makkah/KSA – Assistant Professor January 2011 – January 2012**

- Teaching Undergraduate computer science courses such as Parallel Programming, Data Structures and Algorithms.
- Supervising Graduation Projects.

**University of Sydney – Centre for Infectious Disease and Microbiology – Western Clinical School, Faculty of Medicine, Sydney/Australia – Research Fellow April 2008 - January 2011**

- Apply Computational and Mathematical models to biological data to extract information.
  - Developed a high performance optimal multiple sequence alignment tool.
  - Designed a clustering method for DNA sequences to identify species that outperformed state of the art machine learning algorithms.
  - Building a database of molecular sequences that interfaces with analysis tools.
  - Published the research results in conferences as 1 poster, 1 abstract, and 4 conference papers, 3 journal papers, and there are some unpublished work.

**CMCRC, Database Administrator, Dec 2007 – April 2008**

- **Platform:** Win XP
- **Technologies Used:** Java Programming Language, Eclipse, Postgre RDBMS
- **Duties:**
  - Stock Analysis and Management Application Development
  - Data Analysis and Mining,
  - Database Development and Administration.

**IT Realm, IT Support Engineer, May 2004 – Nov. 2007**

- **Platform:** Win 2K Server, Win 2003 Server, Win XP
- **Technologies Used:** ASP.Net, VB.NET, C#, SQL Server 2K, HTML, JavaScript, VBScript, ASP, Front Page 2K, Adobe Photoshop 7, Adobe ImageReady 7, Macromedia Flash, Fireworks, and DreamWeaver MX, GFI FaxMaker 10, Veritas Backup,
- **Duties:**
  - Online HelpDesk Application
  - Web Site Development and Maintenance
  - PC and network support.
  - IT Supplies Purchasing

**University of New South Wales, Sydney – Computer Science and Engineering Department – Topup PhD Student and CS Tutor March 2004 - December 2007**

- CS Tutor and Course administrator for various CS Courses.

**University of Technology, Sydney – Information Technology Faculty – Cisco Instructor and CS**

**Tutor September 2003 - July 2004**

- Visitor Researcher for the month of September 2003.
- Cisco Instructor and CS Tutor.

**Cairo Software Services (CSS), Product Manager March 2003 - June 2003**

- Arabic Microsoft Business Solution Great Plains Product Manager.
- Establish the constitution of the product team, ensuring relevant consultation with all affected groups and internal users within the company.
- Develop, maintain and implement the Product Business Plan throughout the Product Team's life. Support the Sales and Marketing activities related to the Product, in particular, to provide assistance with demonstrations

and responses to Requests for Information and Invitations to Tender. Ensure that the Product keeps abreast of market changes.

**American University in Cairo (AUC) January 2001 - August 2003**

**1. Engineering Services (AUC) – Cairo Part Time Instructor February 2003 - May 2003**

- Conducting Classes and Lab Sessions.
- Evaluating and grading papers, assignments, and exams.
- Preparing Teaching Outline, Manual, Tools and illustration materials.
- E-Business, Online Security and Payments

**2. Center for Adult and Continuing Education (CACE) - (AUC) , Cairo - Part Time Instructor , October 2002 - August 2003**

- Conducting Classes and Lab Sessions.
- Evaluating and grading papers, assignments, and exams.
- Preparing Teaching Outline, Manual, Tools and illustration materials.
- Java Script.
- ASP and ADO
- XML Technologies E-Commerce and E-Security.
- Project Management.
- Cisco Instructor.

**3. Computer Science Department, Cairo - Part Time Teaching Assistant , January 2001 to May 2003**

- Conducting Lab Sessions (UML, Rational Rose, MS Project, Web Development – ASP, JSP, Servlets, Dream Weaver).
- Evaluating and grading papers and assignments.
- Assisting Students in Lab, and following up with project progression.

**Yat Education Centre- Cairo - Freelancer Instructor, January 2003 to February 2003**

- Conducting Classes and Lab Sessions.
- Evaluating and grading papers, assignments, and exams.

**Aptech Global Training - Cairo - Instructor / Counsellor, April 2002 to September 2002**

- Conducting Classes and Lab Sessions.
- Evaluating and grading papers, assignments, and exams.
- Preparing Teaching Tools and illustration materials:
  - Microsoft Visual Basic for Office Development (mainly for Power Point)
  - Introduction to SQL Server 2000 OLAP and MDX.
- Counselling Students.
- Analysing Corporate Training needs and Preparing Corporate Training Courses Proposals and Outline.
- Designing Corporate Web Site, and Intranet Applications.

**Savola Sime Egypt, Cairo - Senior Systems Analyst December 1999 - December 2001**



- Determining in conjunction with the business community and accounting management the requirements for new or enhanced IT solutions.
- Analysing and documenting the new and enhanced IT solutions, and develop QA inspections for the design.
- Produce test plans, lead and assist in the testing of software modules, Collection of data for the Data Warehouse and Reporting Design.
- Building corporate knowledge base and applying Data Mining concepts using several tools like Business Objects.
- Design, develop, support, and enhance core business applications. Building company's Intranet Solution.

**Asea Brown Boveri (ABB), Cairo - Software Consultant April 1998 - November 1999**

- Customizations & Queries & Training on Triton (BAAN) and CMAS AS/400 applications.
- Procurement of computers and its accessories.
- Lotus Notes support, development, and server administration.
- Developing database applications, and maintaining existing applications.
- PC and Network support (Windows NT, and Novell).

**Microsoft Corporation Third-Party Development Project, Cairo - Software Developer March 1996 to April 1997**

- Participated in the implementation of the Arabic Grammar Checker (AGC) project implemented for the Microsoft Corporation, and launched with its Office 2000 release.

**Data Management Systems (DMS), Cairo - Software Engineer December 1996 - March 1998**

- In charge of meeting customers, analysing their needs, and designing software architecture.
- Managing development, maintenance, and deployment of several projects.
- Coordinating the workflow between the team members.
- Conducting Courses and training Sessions on a variety of Software development tools and techniques, concepts, and some application concepts. Implementation, Testing, maintenance of software. Documentation, and writing user manuals and on-line help

**T3A Pharma Group, Cairo - Software Engineer September 1995 - November 1996**

- Implemented tailored business applications, and designed database applications.
- Worked in the HIC (Health Information Centre), doing systems for the pharmaceutical data processing (Therapeutic Classes), and other drug production cycle tailored systems. Responsible for training users.

**Centre for Adult and Continuing Education (CACE) – American University in Cairo (AUC) - Junior Summer Program (JSP) – Computer Teacher Summers of 1995 and 2003**

- Teach computer basics to juniors

<b>TRAINING &amp; CERTIFICATES</b>
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- **CCNA: Cisco Certified Network Associate Instructor, April 2004**
- **Aptech Certified Instructor for:**
  - "Database Design With MS SQL 2000", **May 2002**
  - "CORE JAVA", **May 2002**

- "Web Design with Dream Weaver" , June 2002
- "Database Design With MS SQL 2000" , May 2002
- OTU Java Programming - IBM Education department , October 2000
- Object Oriented Technology Using Java - IBM Education department , September , 2000
- Introduction to Java - IBM Education department, August 2000.
- Preinstalling and Deploying Microsoft Windows 2000 Professional - One Day Training, Microsoft Certified Technical Education Centre, April 2000.
- Installing and Configuring Microsoft Windows 2000, April 2000.
- File, Print, Web Servers - One Day Training Microsoft Certified Technical Education Centre, February 2000
- Visual Basic Advanced Topics - IBM Education department, January 2000
- Visual Basic Crystal Report - IBM Education department Visual Basic Interface- IBM Education department , December 1999

## REFERENCES

Available upon request: Include reference letters from my professors at the universities where I studied and worked, and references from the companies I worked for.