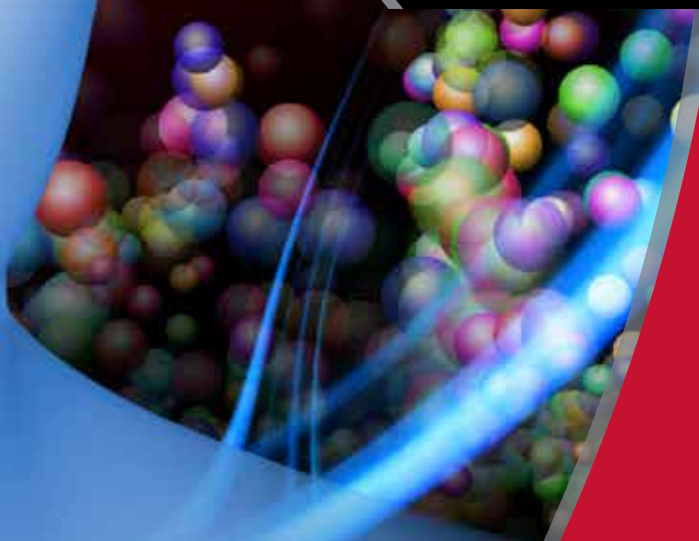




Research Initiatives



Carnegie Mellon University Qatar



Research

Research has always been an integral part of the undergraduate educational experience at Carnegie Mellon; our faculty fully integrate undergraduates into their diverse research programs. A significant number of our faculty have active research programs that are funded by the Qatar National Research Fund and our own internal Seed Research Fund, creating a vibrant research environment for faculty, staff and undergraduate students.

Funded research projects cover the disciplines that are taught at Carnegie Mellon Qatar: Biological Sciences, Business Administration, Computational Biology, Computer Science and Information Systems. In addition, there are significant research efforts from our faculty in other areas, including mathematics, languages, environmental science and other social sciences. Our faculty collaborate with colleagues

at the main campus in Pittsburgh and other institutions in Education City, as well as Qatar University, Hamad Medical Center and major research universities around the world.

Qatar National Research Fund

The Qatar National Research Fund (QNRF) was established by Qatar Foundation in 2006 as part of its ongoing commitment to establish Qatar as a knowledge-based economy.

The National Priorities Research Program (NPRP)

This program is the major funding program in Qatar and encourages research activities that are aligned with the Qatar National Research Strategy, which is centered around the following themes: energy and environment, computer science and ICT, health, social sciences, and arts and



humanities. A total of 16 proposals were submitted in cycle six of this program. Of these, two proposals were awarded, with a combined three-year budget of 1.9 million USD.

The funded proposals were:

- OPTDIAC: An Optimal Diacritization Scheme for Arabic Orthographic Representation, Dr. Kemal Oflazer.
- Adherence and Biofilm Formation of Pathogenic Fungi from the Qatari Clinical Setting, Dr. Jonathan Finkel.

Since the inception of the NPRP funding program, faculty from Carnegie Mellon Qatar have submitted 105 proposals, of which 35 have been accepted for funding, 27 are still active, six have been completed and two awards are pending. For a list of NPRP-funded projects in the first five award cycles, see Appendix A.

Junior Scientist Research Experience Program (JSREP)

This program is designed to support junior scientists in leading their own research initiatives. Two post-doctoral fellows at Carnegie Mellon Qatar submitted JSREP proposals this year and both were awarded with three years of funding for a total of 600,000 USD:

- Reimplementing Dependent Pattern Matching and Termination Checking in the Coq Theorem Prover, Dr. Jorge Sacchini
- Effective Parallel and Distributed Programming via Join Pattern with Guards, Propagation and More, Dr. Edmund Lam

Carnegie Mellon Research Projects

Seed Research Projects

Long-term faculty at Carnegie Mellon Qatar can complete for up to 200,000 USD in Seed Research Funds. These funds are available to encourage faculty to explore new areas of research and to provide the resources needed to obtain preliminary data for QNRF funding in one of the five focus areas for NPRP awards.

Our high success rate in obtaining NPRP awards from QNRF attests to the importance of Seed funding. The Seed Research Funding is also an important component of faculty development and enhances the environment for undergraduate research. A total of 56 faculty have received Seed funding since the program began in 2004.

This year, the following Seed grants were awarded to our faculty:

- Toward a Toolkit for a Leader, Dr. Ludmilla Hyman
- Fungal Pathogens in Qatar, Dr. Jonathan Finkel
- IT Entrepreneurship in Qatar and the MENA Region, Dr. Hakim Maher
- The Qatar Experience: A Study of Social Network Systems Addiction and the Cognition of Information Ethics, Dr. Ray Tsai
- Examining Leadership and Social Capital in Online Organization, Dr. Ben Collier

Seed funding is also available to purchase capital equipment to enhance the research infrastructure at Carnegie Mellon Qatar. For example, seed funds were used to install and support cloud computing facilities, as well as provide essential instrumentation for our new Biological Sciences program.

Student-Initiated Undergraduate Research Program (SIURP)

Carnegie Mellon has been a leader in undergraduate research for decades. Carnegie Mellon in Qatar has continued that tradition with the Student-Initiated Undergraduate Research Program (SIURP), which supports student-initiated research and encourages students to develop cross-disciplinary projects while being mentored by Carnegie Mellon Qatar faculty.

The Fellowship for Student-Initiated Undergraduate Research awards up to 4,000 USD for research in any area, as long as the research can be conducted on campus. Carnegie Mellon Qatar students work with a faculty advisor to participate in the program. This year, the following projects were funded:

- Leveraging Past Data in Predicting Future Price of Natural Gas for Qatar, Rafay Abbasi and Saad Ahmed with Dr. Fuad Farooqi
- Testing Value Premium in the GCC Markets: 1992–2012, Noorhuda Admaney and Tanzeel Huda with Dr. John Gasper





Student and Professor Recognized at Annual Research Forum

Dr. Khaled Harras won the Best Computing and Information Technology Research Program at Qatar Foundation's third Annual Research Forum for "OPERETTA: An Optimal Deployable Energy Efficient Bandwidth Aggregation System," a collaborative project with the Egypt-Japan University of Science and Technology in Egypt. Harras' project builds on previous attempts to improve multi-interface mobile devices, such as smartphones, by allowing users to concurrently connect to the Internet in different ways, such as 3G, 4G, WiFi and Bluetooth.

Dania Aded Rabbou, a 2012 graduate in computer science, received the Best Student Computing and Information Technology Research Award for a senior thesis project titled, "SCOUT: Extending the Reach of Social-Based Context-Aware Ubiquitous Systems."

- Look at Me: Enhancing Agent Gaze Direction Through the Use of Computer Vision, Mahmoud Al-Ismael with Dr. Majd Sakr
- Using Barcodes & Smartphones to Help Consumers and Supermarkets Save Food Effortlessly, Sabih Bin Wasi with Dr. Thierry Sans
- Contextual Spellchecker to Improve Human-Robot Interaction, Naassih Gopee with Dr. Majd Sakr
- Descriptive Minicomplexity, Lamana Mulaffer with Dr. Christos Kapoutsis
- Course Scheduling at CMUQ, Amalan Roshan and Anish Sridhar with Dr. John Gasper

Research Highlights



Adherence and Biofilm Formation of Pathogenic Fungi from the Qatari Clinical Setting

The Team

- Jonathan Finkel Ph.D., Carnegie Mellon Qatar
- Saad Taj-Aldeen, Ph.D., Hamad Medical corporation
- Mei El Gindi, Raji Katibe and Ridin Balakrishnan, Biological Sciences students

Funding

Qatar National Research Fund's National Priorities Research Program (NPRP)

Project

Deep tissue fungal infections have a mortality rate of approximately 30 percent. A primary source of infection arises from the fungus' ability to grow as a biofilm on implanted devices. This project aims to characterize the biofilm and adherence capabilities of pathogenic fungi isolated at Hamad Medical Center. The goal of this study is to better understand how these fungi are able to infect patients and to aid in the effective treatment.

Impact

Fungal infections are of great concern in Qatar with its high rate of diabetes and increased use of implanted devices. These infections will cause increases in mortality and health care costs, and reduce productivity. The findings of this work will provide fundamental information for improvement in biomaterials and therapeutics, with direct relevance to the Qatari population.



Raising Language Effectiveness in Arabic Ecommerce Websites

The Team

- Divakaran Liginlal, Ph.D., Carnegie Mellon Qatar
- Robert Meeds, Ph.D., and Rizwan Ahmad, Ph.D., Qatar University
- Sama Kanbour, Information Systems student

Funding

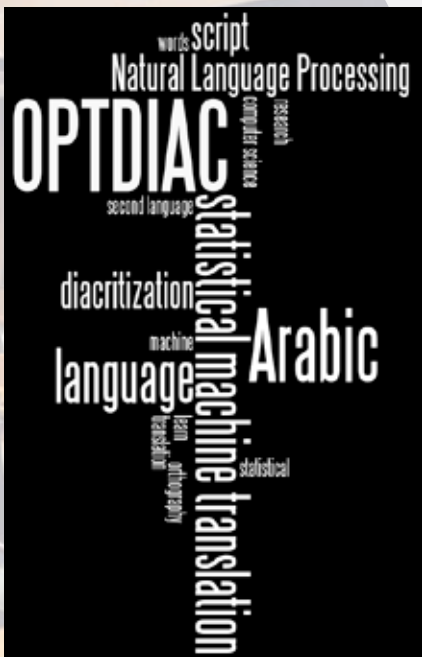
Qatar National Research Fund's National Priorities Research Program (NPRP)

Project

Many Arabic e-commerce websites are literal translations of their English versions, which fail to capture the real meaning or richness of expression and detail of the Arabic language. The research proposes to analyze the content of e-commerce websites in 22 Arab countries through corpus studies and eye tracking experiments. The final phase involves developing and communicating best practices for designers and Arabic language translators and creating a repository of design and content patterns for Arabic e-commerce websites.

Impact

The project will benefit global companies planning to establish business in the region as well as Arabic speakers using e-commerce websites.



OPTDIAC: An Optimal Diacritization Scheme for Arabic Orthographic Representation

The Team

- Mona Diab, Ph.D., George Washington University
- Kemal Oflazer, Ph.D., and Zeinab Ibrahim, Ph.D., Carnegie Mellon Qatar

Funding

Qatar National Research Fund's National Priorities Research Program (NPRP)

Project

The majority of Arabic script is written without diacritics (marks that are added to letters to represent short vowel sounds) and these sounds have to be inferred by readers using context. This project aims to develop new systematic orthographical standards for Arabic that employ different levels of diacritics to gently introduce native and second language learners of Arabic to the problem of inferring these with increasing levels of reading competence.

Impact

By learning to read and write in Arabic script with just the sufficient amount of diacritization, students will be able to understand the functionality of diacritization and achieve full reading and writing skills faster and with better accuracy. This can have a measureable impact on literacy rates in Qatar and the region. In addition, a fully automated partial optimal diacritization tool to be developed during this project will be of great benefit to publishing houses like QScience and Bloomsbury Qatar that publish texts in Arabic for a variety of audiences ranging from elementary school students to adults and second language learners, who each require varying levels of diacritization.



Undergraduate Discipline-Specific Writing: Expectation, Demands, & Development

The Team

- Silvia Pessoa, Ph.D., Carnegie Mellon Qatar
- David Kaufer, Ph.D., Carnegie Mellon
- Shivani Arora, Anas Helbawi, Humaira Tasnim, Tasneem Jahan, Sumya Khandaker, Jevika Shetty, Sakib Mahmoud, Ernest Appiah, Syed Haider, Fawwaz Farid, Muhammad Suhaib, Alaa Khader, Narjis Premjee, Shafiya Fasalu, Reem Saad, Wadha Al-Jaber, Mohamed Zehni Khairullah

Funding

Qatar National Research Fund's National Priorities Research Program (NPRP)

Project

This study examines the expectations, challenges, and linguistic demands of student writing at Carnegie Mellon Qatar. By employing a longitudinal methodology, the study also documents the writing development of the 85 students who participated. The project aims to advance knowledge in the area of writing development at the college level and better understand teacher and discipline expectations and contextual factors influencing development.

Impact

Understanding the challenges of undergraduate academic writing in English is pivotal as Qatar continues to invest in English-medium education to build its human capital.

Appendix A

National Research Priorities Program Grants Awarded to Carnegie Mellon Qatar Faculty

Cycle 1		
Lead PI in Qatar	NPRP	Title
Amal Al-Malki, Ph.D.	NPP29-6-7-9	Images of Muslim Women in Translated Mideast Media Sources: A Content and Discourse Analysis
Majd Sakr, Ph.D.	NPRP 29-6-7-24	Human - Robot Interaction in an Arabic Social and Cultural Setting
Bernardine Dias, Ph.D.	NPRP 1-7-7-5	Automated Tools for Effective Team Coordination in Emergency Response
Bernardine Dias, Ph.D.	NPRP 30-6-7-91	Enhanced Education for the Visually and Aurally Impaired Using Automated Tutors and Interactive Computer Games
Jon Caulkins, Ph.D.	NPRP 20-6-7-6	Modeling Control of Infectious Disease
Charles Thorpe, Ph.D.	NPRP 29-6-7-43	Intelligent Diabetes Assistant: Predicting and Optimizing Blood Glucose
Cycle 2		
Alex Rojas Pena, Ph.D.	NPRP 08-643-1-112	Automated Measurement of Galaxy Morphology
Brett Browning, Ph.D.	NPRP 08-589-2-245	Non-Destructive Gas Pipeline Inspection Using Computer Vision
Khaled Harras, Ph.D.	NPRP 08-562-1-095	Coverage, Networking, and Storage Problems in Wireless Multimedia Sensor Networks
Kemal Oflazer, Ph.D.	NPRP 08-485-1-083	Improved Arabic Natural Language Processing through Semi supervised and Cross-Lingual Learning
Cycle 3		
Silvia Pessoa, Ph.D.	NPRP 09-857-5-123	Transnational Labor Migration in Qatar: An Empirical Sociological Analysis
Kemal Oflazer, Ph.D.	NPRP 09-1140-1-177	Learning from Comparable Corpora for Improved English-Arabic Statistical Machine Translation
Bernardine Dias, Ph.D.	NPRP 09-980-2-380	Robust Localization and Mapping for Autonomous Gas Inspection Vehicles
Majd Sakr, Ph.D.	NPRP 09-1116-1-172	Qloud: Towards a Cloud Computing Infrastructure in Qatar to Target Regional Scientific Applications
Majd Sakr, Ph.D.	NPRP 09-1113-1-171	Towards Natural Multi-Cultural Human-Robot Interaction
Kemal Oflazer, Ph.D.	NPRP 09-873-1-129	A Natural Language Processing-based Active and Interactive Platform for Accessing English Language Content and Advanced Language Learning
Iliano Cervesato, Ph.D.	NPRP 09-1107-1-168	Formal Reasoning about Language for Distributed Computation
Iliano Cervesato, Ph.D.	NPRP 09-667-1-100	Effective Programming for Large Distributed Ensembles
Cycle 4		
Vinay Kolar, Ph.D.	NPRP4-1620-1-266	Large-scale, Personal and Mobile Sensor Networks and their Applications in Qatar
Mary Dias, Ph.D.	NPRP4-439-1-071	Innovative Computing and Mobile Technology for Improving English Literacy Skills for Children and for Adults

Mary Dias, Ph.D.	NPRP4-1330-1-213	Cooperative Robotic Boats for Monitoring Coastal and Flooded Areas
Andreas Karatsolis, Ph.D.	NPRP4-1538-6-048	Improving Professional Communication Skills through an Online Tutorial
Iliano Cervesato, Ph.D.	NPRP4-341-1-059	Usable Automated Data Inference for End-users
Dudley Reynolds, Ph.D.	NPRP4-1172-5-172	Improving Reading Skills in the Middle School Science Classroom
Kemal Oflazer, Ph.D.	NPRP4-1058-1-168	Automatic Correction of Standard Arabic Text: Resource and System Development
Hasan Demirkoparan, Ph.D.	NPRP4-1138-1-178	New Mathematical Models for the Large Strain Swelling Response of Biological Tissues
Hasan Demirkoparan, Ph.D.	NPRP4-1333-1-214	Complex Material Response Described by Continuum Mechanics with a Deformation Gradient Product Decomposition that has Novel Hyperelastic Implications
Zeinab Ibrahim, Ph.D.	NPRP4-1074-5-164	Advancing Arabic Language Learning in Qatar

Cycle 5

David Fossati, Ph.D.	NPRP 5-939-1-155	Intelligent Learning Environments for Computer Science Undergraduate Education
Zeinab Ibrahim, Ph.D.	NPRP 5-1393-6-044	Raising Language Effectiveness in Arabic Ecommerce Websites
Yonina Cooper, Ph.D.	NPRP 5-1070-2-451	Alice for Middle East - Alice ME
Silvia Pessoa, Ph.D.	NPRP 5-1320-6-040	Undergraduate Discipline-Specific Writing: Expectations, Demands, & Development



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