

# **Mohammed Nayef Al-Refai**

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## **EDUCATION**

2019, **Ph.D. in Computer Science**, Colorado State University, Fort Collins, Colorado.

Dissertation: *Towards Model-based Regression Test Selection* (Advisor: Sudipto Ghosh)

2007, **M.S. in Computer Science**, Jordan University of Science and Technology, Irbid, Jordan.

Thesis: *Feature Reduction Techniques for Arabic Text Categorization* (Advisor: Rehab Duwairi)

2004, **B.Sc. in Computer Science**, Jordan University of Science and Technology, Irbid, Jordan.

## **PROFESSIONAL EXPERIENCE**

- Full Time Assistant Professor. Computer Science Department, Jordan University of Science and Technology, Irbid, Jordan. **January 2020 – until now.**
- Deputy Director. Information Technology and Communications Center (ITCC), Jordan University of Science and Technology, Irbid, Jordan, **September 2020 - September 2022.**

## **RESEARCH INTERESTS**

- Software Engineering, particularly in modeling and testing of software. Specific topics include model-based software development, regression test selection, and mutation testing.
- The application of fuzzy logic and machine learning techniques in different domains including regression test selection, information retrieval, and natural language processing.

## HIGHLIGHTS OF MY PhD WORK

- My PhD work is within the area of model-based validation and regression test selection (RTS).
- The goal was to develop a set of new model-based RTS approaches to improve the safety, precision, reduction, and fault detection ability of model-based RTS. We proposed and developed the following approaches:
  - **MaRTS**. A dynamic **Model-based Regression Test Selection** approach that classifies test cases based on adaptations performed to executable UML class and activity models that represent fine-grained behaviors of a software system under test.
  - **FLiRTS**. A static **Fuzzy Logic-based Regression Test Selection** approach that classifies test cases based on adaptations performed to UML sequence and activity models that represent dynamic behaviors of a software system at a high level of abstraction. FLiRTS uses fuzzy logic to address the uncertainty in the traceability links from test cases to the elements of the behavioral models.
  - **FLiRTS 2**. A static **Fuzzy Logic-based Regression Test Selection** approach that classifies test cases based on adaptations performed to UML class models that represent structural aspects of a software system at a high level of abstraction. FLiRTS 2 uses fuzzy logic to address the uncertainty in the traceability links from test cases to the elements of the class models.
- We conducted a large evaluation of the proposed work on more than 8000 revisions of real-world open source projects. We compared the results obtained by our RTS approaches with those obtained by the state-of-art code-based RTS approaches. To the best of our knowledge, this is the largest evaluation of RTS approaches in terms of the number of used revisions, and the first evaluation that compares model-based and code-based RTS approaches.

## PUBLICATIONS

### **Journal Publications**

- [1] Cazzola, Walter, Sudipto Ghosh, **Mohammed Al-Refai**, and Gabriele Maurina. "Bridging the model-to-code abstraction gap with fuzzy logic in model-based regression test selection." *Software and Systems Modeling* 21, no. 1 (2022): 207-224.
- [2] Tashtoush, Yahya, **Mohammed Al-Refai**, Ghaith Al-refai, Dirar Abdul-Kareem Darweesh, Noor Zaghal, and Omar Darwish. "Dynamic Traffic Light System to Reduce The Waiting Time of Emergency Vehicles at Intersections within IoT Environment." *INTERNATIONAL JOURNAL OF COMPUTERS COMMUNICATIONS & CONTROL* 17, no. 3 (2022).
- [3] Al-refai, Ghaith, and **Mohammed Al-Refai**. "Road Object Detection using Yolov3 and Kitti Dataset." *International Journal of Advanced Computer Science and Applications* 11, no. 8 (2020).
- [4] **M. Al-Refai**, S. Ghosh, and W. Cazzola. Supporting Inheritance Hierarchy Changes in Model-based Regression Test Selection. *Software and Systems Modeling*, Springer, 2017.

## Conference Publications

- [1] Abualsha'ar, Najeeb, Mohammad Al-Jararwah, Ghaith Al-Refai, Anwar Bani Amer, Yahya Tashtoush, and **Mohammed Al-Refai**. "Retrieve Information From Articles By Using Quick Response Code." In 2020 IEEE International Conference on Electro Information Technology (EIT), pp. 001-006. IEEE, 2020.
- [2] Al-Refai, Ghaith, **Mohammed Al-Refai**, Shadi Banitaan, and Zeinab Ghasemi. "Shared Images in A Connected-Vehicle Network Registration System Using Harris-Stephens Approach." In 2020 IEEE International Conference on Electro Information Technology (EIT), pp. 047-052. IEEE, 2020.
- [3] **M. Al-Refai**, S. Ghosh, and W. Cazzola. A Fuzzy Logic Based Approach for Model-based Regression Test Selection, Proceedings of ACM/IEEE 20th International Conference on Model Driven Engineering Languages and Systems, pp. 55-62, Foundations Track, Austin, Texas, USA, September 17-22, 2017.
- [4] **M. Al-Refai**, S. Ghosh, and W. Cazzola. Model-based Regression Test Selection for Validating Runtime Adaptation of Software Systems, Proceedings of the 9th IEEE International Conference on Software Testing, Verification, and Validation, pp. 288-298, Chicago, Illinois, USA, April 10-15, 2016.
- [5] **M. Al-Refai**, W. Cazzola, S. Ghosh, and R. France. Using Models to Validate Unanticipated, FineGrained Adaptations at Runtime, Proceedings of the 17th IEEE International Symposium on High Assurance Systems Engineering, pp. 23-30, Orlando, Florida, USA, January 7-9, 2016.
- [6] **M. Al-Refai**, W. Cazzola, and R. France. Using Models to Dynamically Refactor Runtime Code, Proceedings of the 29th Annual ACM Symposium on Applied Computing (SAC'14), pp. 1108-1113, Gyeongju, Korea, March 24-28, 2014.
- [7] W. Cazzola, N. Rossini, **M. Al-Refai**, and R. France. Fine-Grained Software Evolution using UML Activity and Class Models, Proceedings of the 16th International Conference on Model Driven Engineering Languages and Systems (MODELS'13), pp. 271-286, Miami, FL, USA, September 29 - October 4, 2013.
- [8] R. Duwairi, **M. Al-Refai**, and N. Khasawneh. Feature reduction Techniques for Arabic Text Categorization, Journal of the American Society For Information Science And Technology (JASIST), pp. 2347-2352, Volume 60, Issue 11, June, 2009.

- [9] R. Duwairi, **M. Al-Refai**, and N. Khasawneh. Stemming Versus Light Stemming as Feature Selection Techniques for Arabic Text Categorization, The 4th International Conference on Innovations in Information Technology (Innovations'07), pp. 446-450, Dubai, United Arab Emirates, November 18–20, 2007.

## **Workshops and Fast Abstracts**

- [1] **M. Al-Refai**, A. Jacobson, S. Ghosh, J. M. Bieman, and B. H. C. Cheng. ReMoDD Eclipse Plugin: Collaborative Modeling Using a Model Repository. Proceedings of MODELS Satellite events (First Workshop on Tools for Model Driven Engineering–MDETools'17), pp. 344-348, Austin, Texas, USA, September 17-22, 2017.
- [2] **M. Al-Refai**, Improving Model-based Regression Test Selection. In the Doctoral Symposium at the 20th International Conference on Model Driven Engineering Languages and Systems (Satellite Events), pp. 507-510, Austin, Texas, USA, September 17-22, 2017.
- [3] **M. Al-Refai**, MaRTS: A Model-Based Regression Test Selection Approach. In the ACM Student Research Competition at the 20th International Conference on Model Driven Engineering Languages and Systems (Satellite Events), pp. 555-560, Austin, Texas, USA, September 17-22, 2017.

## **Posters and Demonstrations**

- [1] 2016, **M. Al-Refai**, J. M. Bieman, and S. Ghosh, ReMoDD Repository for Model Driven Development (poster and demo), IEEE International Conference on Software Testing, Verification, and Validation, Chicago, Illinois, USA.
- [2] 2016, **M. Al-Refai**, S. Ghosh, and W. Cazzola, Model-based Regression Test Selection for Validating Runtime Adaptation of Software Systems (poster), IEEE International Conference on Software Testing, Verification, and Validation, Chicago, Illinois, USA.
- [3] 2016, **M. Al-Refai**, S. Ghosh, J. M. Bieman, ReMoDD Tool (demo), IEEE 17th International Symposium on High Assurance Systems Engineering, Orlando, Florida, USA.

## **Publications in other Fields**

I worked in scientific programming development and numerical analysis (for ambient measurements of new particle formation studies) at the Chemistry Department, Kent State University, August 2009 – July 2010. I participated as a co-author in the following publications:

- [1] D. R. Benson, **M. Al-Refai**, and S.-H. Lee. Chemical ionization mass spectrometer (CIMS) for ambient measurements of ammonia. Atmospheric Measurement Techniques Discuss., 3, 1133-1162, 2010.

- [2] Mark E. Erupe, David R. Benson<sup>1</sup>, Jingmin Li, Li-Hao Young, Bart Verheggen, **Mohammed Al-Refai**, Omar Tahboub, Victoria Cunningham, Flavia Frimpong, Albert A. Viggiano and Shan-Hu Lee, Correlation of Aerosol Nucleation Rate with Sulfuric Acid and Ammonia in Kent Ohio: An Atmospheric Observation. *J. Geophys. Res.* 115, D23216, doi:10.1029/2010JD013942.
- [3] Benson, D. R., **M. Al-Refai**, A. Markovich, and S.-H. Lee, CIMS for ambient measurements of ammonia, *Atmos. Meas. Tech.* 3, 1075-1087, 2010.

## **AWARDS**

1. Robert B. France Fellowship, Computer Science Department, Colorado State University, Fort Collins, 2017-2018.
2. Second place winner in ACM Student Research Competition at the 20th International Conference on Model Driven Engineering Languages and Systems, Austin, Texas, 2017.  
Title of Submission: *MaRTS: A Model-Based Regression Test Selection Approach*.

The second place winner receives a silver medal, and a two-year complimentary ACM membership with a subscription to ACM's Digital Library.

## **PROFESSIONAL AFFILIATIONS AND ACTIVITIES**

1. Web chair for the 14th International Conference on Modularity.  
(website: <http://modularity.info/conference/2015/organization.html>)
2. Member in the organizing committee of the 9th International Workshop on Models at run.time.  
(website: <http://st.inf.tu-dresden.de/MRT14/>)
3. Journal reviewer in *Software Quality Journal* published by Springer.
4. Journal reviewer in *PeerJ Computer Science*.

## **Research and Teaching Assistance Experience (during my PhD study at Colorado State University)**

**Research assistant**, Computer Science Department, Colorado State University, Fort Collins.

- Administrator and developer of the Repository for Model-Driven Development (ReMODD). Computer Science Department, Colorado State University, Fort Collins. January 2013 – December 2017.
  - My contributions to ReMoDD included implementing the storage and access functionality for the repository, writing test cases, and documenting requirements and design models.

**Teaching assistant**, Computer Science Department, Colorado State University, Fort Collins.  
Courses:

- CS514, Software Product and Process Evaluation.
- CS414, Object-oriented Design.
- CS430, Database Systems.
- CS253, Problem Solving with C++.
- CS161, Object Oriented Problem Solving.

## **COMPUTER AND SOFTWARE SKILLS**

- **Programming languages:** Java, C++, Python, SQL, Visual Basic, MATLAB, and .NET programming Languages.
- **Regression test selection tools:** Ekstazi (<http://ekstazi.org/>), STARTS (<https://github.com/TestingResearchIllinois/starts>), and HyRTS (<http://www.hyrts.org/>).
- **Test case generation tools:** Randoop (<https://randoop.github.io/randoop/>) and EvoSuite (<http://www.evosuite.org/>).
- **Mutation testing tools:** PIT (<http://pitest.org/>) and MuJava (<https://cs.gmu.edu/~offutt/mujava/>).
- **Software modeling tools and languages:** Unified Modeling Language (UML), Object Constraint Language (OCL), Alloy, and Rational Software Architect.
- **Testing frameworks:** JUnit test framework for Java software.
- **Internet and web design:** HTML, Java script, Drupal, PHP.
- **Operating systems:** Unix and Windows.
- **Other applications:** LaTeX, Microsoft Office, and SPSS statistical package.