# Self-Adaptation in Smartphone Applications: State-of-the-Art Techniques, Challenges, and Future Directions

Mughees Ali[a,*], Saif Ur Rehman Khan[a], Shahid Hussain[b]

[a]Department of Computer Science, COMSATS University Islamabad (CUI), ISB Pakistan

[b]Department of Computer and Information Science, University of Oregon, USA

## Appendix A

**Appendix A. General Information about the Selected Studies**

| No. | Reference | Paper Title | Author Name/s | Year of Publication | Venues and Source of Publication |
|---|---|---|---|---|---|
| 1. | [16] | "A cognitive-based ego network detection system for mobile social networking" | • Matteo Mordacchini<br>• Andrea Passarella<br>• Marco Conti | 2015 | IEEE Conference, 8th IFIP Wireless and Mobile Networking Conference |
| 2. | [17] | "A Proactive Approach for Context-Aware Self-Adaptive Mobile Applications to Ensure Quality of Service" | • Md. Shafiuzzaman<br>• Nadia Nahar<br>• Md. Rayhanur Rahman | 2015 | IEEE Conference, 18th International Conference on Computer and Information Technology (ICCIT) |
| 3. | [18] | "A Self-Adaptive Multi-Agent System Approach for Collaborative Mobile Learning" | • Didac Gil de la Iglesia<br>• Juan Felipe Calderon<br>• Danny Weyns<br>• Marcelo Milrad<br>• Miguel Nussbaum | 2015 | IEEE Journal, Transactions on Learning Technologies |
| 4. | [19] | "Context-Driven Progressive Enhancement of Mobile Web Applications: A Multi | • Heiko Desruelle<br>• Frank Gielen | 2015 | IEEE Journal, Computer and Communications Networks and Systems The Computer Journal |

| | | | | | |
|---|---|---|---|---|---|
| | | criteria Decision-Making Approach" | | | |
| 5. | [6] | "Enhanced Accident Detection System Using Safety Application for Emergency in Mobile Environment: SafeMe" | • Amit Hirawat<br>• Deepshikha Bhargava | 2015 | Springer India Conference, 4th International Conference on Soft Computing for Problem Solving, Advances in Intelligent Systems and Computing |
| 6. | [14] | "S-Aframe: Agent-based Multi-layer Framework with Context-aware Semantic Service for Vehicular Social Networks" | • Xiping Hu,<br>• Jidi Zhao,<br>• Boon-Chong Seet,<br>• Victor C. M. Leung,<br>• Terry H. S. Chu,<br>• Henry C. B. Chan | 2015 | IEEE Journal, Transactions on Emerging Topics in Computing |
| 7. | [20] | "Self-adaptation of mobile systems driven by the Common Variability Language" | • Gustavo G. Pascual,<br>• Mónica Pinto,<br>• Lidia Fuentes | 2015 | Elsevier Journal, Future Generation Computer Systems |
| 8. | [4] | "Adaptive Deployment Infrastructure for Android Applications" | • Junior Cupe Casquina<br>• Jane D.A. Sandim Eleuterio<br>• Cecilia M.F. Rubira | 2016 | IEEE Conference, 12th European Dependable Computing Conference |
| 9. | [7] | "Fighting Weight Problems and Insulin Resistance with the Metabolic Health Monitor App for Patients in the Setting of Limited Access to | • Zsolt Ori,<br>• Ilona Ori | 2016 | IEEE Conference, Global Humanitarian Technology Conference |

| | | Health Care in Rural America" | | | |
|---|---|---|---|---|---|
| 10. | [21] | "Generic Context Adaptation for Mobile Cloud Computing Environments" | • Gabriel Orsini,<br>• Dirk Bade,<br>• Winfried Lamersdorf | 2016 | Elsevier Conference, The 13th International Conference on Mobile Systems and Pervasive Computing |
| 11. | [22] | "MAsCOT: Self-adaptive Opportunistic Offloading for Cloud-Enabled Smart Mobile Applications with Probabilistic Graphical Models at Runtime" | • Nayyab Zia Naqvi,<br>• Jonas Devlieghere,<br>• Davy Preuveneers,<br>• Yolande Berbers | 2016 | IEEE Conference, 49th Hawaii International Conference on System Sciences |
| 12. | [10] | "On the Importance of Spatial Perception for the Design of Adaptive User Interfaces" | • Tilman Deuschel,<br>• Ted Scully | 2016 | IEEE Conference, IEEE 10th International Conference on Self-Adaptive and Self-Organizing Systems |
| 13. | [23] | "Recommending Features of Mobile Applications for Developer" | • Hong Yu,<br>• Yahong Lian,<br>• Shuotao Yang,<br>• Linlin Tian,<br>• Xiaowei Zhao | 2016 | Springer Conference, International Publishing AG 2016 |
| 14. | [24] | "Self-adaptive Step Counting on Smartphones under Unrestricted Stepping Modes" | • Zihao Tang,<br>• Yao Guo,<br>• Xiangqun Chen | 2016 | IEEE Conference, IEEE 40th Annual Computer Software and Applications Conference |
| 15. | [11] | "Improving the User Experience using an Intelligent Adaptive User Interface in Mobile Applications" | • Saeed Raheel | 2016 | IEEE Conference, International Multidisciplinary Conference on Engineering Technology (IMCET) |

| 16. | [2] | "A Self-adaptive Framework for Enhancing Energy Efficiency in Mobile Applications" | • Fahimeh Alizadeh Moghaddam, <br> • Mario Simaremare | 2017 | IEEE Conference, Sustainable Internet and ICT for Sustainability |
|---|---|---|---|---|---|
| 17. | [25] | "Cloud Aware: Empowering context-aware self-adaptation for mobile applications" | • Gabriel Orsini <br> • Dirk Bade <br> • Winfried Lamersdorf | 2017 | Wiley Journal, Trans Emerging Tel Tech |
| 18. | [26] | "Crowd-Based Programming for Reactive Systems" | • David Harel, <br> • Idan Heimlich, <br> • Rami Marelly <br> • Assaf Marron | 2017 | IEEE/ACM 4th International Workshop on Crowd Sourcing in Software Engineering (CSI-SE) |
| 19. | [27] | "Dynamic Adaptation and Reconfiguration of Security in Mobile Devices" | • Mohamed AMOUD, <br> • Ounsa ROUDIES | 2017 | IEEE Conference, International Conference on Cyber Incident Response, Coordination, Containment & Control |
| 20. | [28] | "Using Emotions to Empower the Self-adaptation Capability of Software Services" | • Nelly Condori-Fernandez, <br> • Franci Suni Lopez | 2017 | IEEE/ACM 2nd International Workshop on Emotion Awareness in Software Engineering |
| 21. | [1] | "An adaptive smartphone anomaly detection model based on data mining" | • Xue Li Hu, <br> • Lian Cheng Zhang <br> • Zhen Xing Wang | 2018 | Springer Journal, EURASIP Journal on Wireless Communications and Networking |
| 22. | [29] | "Autonomic Adaptation of Multimedia Content Adhering to Application Mobility" | • Francisco Javier Velazquez-Garcıa, <br> • Pal Halvorsen, <br> • Hakon Kvale Stensland, <br> • Frank Eliassen | 2018 | Springer Conference, IFIP International Federation for Information Processing 2018 |

| 23. | [15] | "ProMETheus: An Intelligent Mobile Voice Meeting Minutes System" | • Hui Liu,<br>• Xin Wang,<br>• Yuheng Wei,<br>• Wei Shao,<br>• Jonathan Liono,<br>• Flora D. Salim,<br>• Bo Deng,<br>• Junzhao Du | 2018 | ACM, Proceedings of the 15th EAI International Conference on Mobile and Ubiquitous Systems: Computing, Networking and Services |
|-----|------|-----------------|-----------------|------|------------------|
| 24. | [8] | "Real-time Smartphone application for improving spatial awareness of Hearing Assistive Devices" | • Anshuman Ganguly,<br>• Abdullah Küçük,<br>• Issa Panahi | 2018 | IEEE Conference, 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC) |
| 25. | [30] | "A Reference Architecture to support the development of mobile applications based on self-adaptive services" | • Frank Jose Affonso,<br>• William Filisbino Passini,<br>• Elisa Yumi | 2019 | Elsevier Journal, Pervasive and Mobile Computing |
| 26. | [31] | "CAMeL: A Self-Adaptive Framework for Enriching Context-Aware Middlewares with Machine Learning Capabilities" | • Nicola Bicocchi,<br>• Damiano Fontana,<br>• Franco Zambonelli | 2019 | Hindawi Journal, Mobile Information Systems |
| 27. | [9] | "Energy Efficient Adaptation Engines for Android Applications" | • Angel Canete,<br>• Jose-Miguel Horcas,<br>• Inmaculada Ayala,<br>• LidiaFuentes | 2019 | Elsevier Journal, Energy Efficient Adaptation Engines for Android Applications |
| 28. | [12] | "Malware Detection in Android System Based on Change Perception" | • Hua-li Zhang,<br>• Hua-yong Yang,<br>• Fan Yang,<br>• Wei Jiang | 2019 | Springer Conference, International Conference on Intelligent Computing |

| 29. | [32] | "Mobile User Environment Detection using Deep Learning based Multi-Output Classification" | • Illyyne Saffar, <br>• Marie Line Alberi Morel, <br>• Mohanned Amara, <br>• Kamal Deep Singh, <br>• Cesar Viho | 2019 | IEEE Conference, 12th IFIP Wireless and Mobile Networking Conference (WMNC) |
|---|---|---|---|---|---|
| 30. | [3] | "Self-Adaptation in Mobile Apps: a Systematic Literature Study" | • Eoin Martino Grua, <br>• Ivano Malavolta, <br>• Patricia Lago | 2019 | IEEE Conference, IEEE/ACM 14th International Symposium on Software Engineering for Adaptive and Self-Managing Systems |
| 31. | [33] | "Dynamic adaptation of service-based applications: a design for adaptation approach" | • Martina De Sanctis, <br>• Antonio Bucchiarone <br>• Annapaola Marconi | 2020 | Springer Journal, Journal of Internet Services and Applications |