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| **First Supervisor** | Dr John Panneerselvam | | |
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**Section 2 – *Project Information***

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| **Project Title** | **Artificial Intelligence approach for Sustainable Datacentres** | |
| **Project Highlights:** | 1. | Develop solutions for real-world cloud datacentres to optimise their server energy consumption |
| 2. | Analyse large-scale cloud datacentre trace logs and develop intelligent approaches for energy-efficient processing of cloud workloads |
| 3. | High-quality publications in reputable journals and conferences, and contribution to writing research proposals. |
| **Project Summary** | | |
| Climate change and sustainability is of global importance. Cloud datacentres are addressed as massive energy consumers and a source of environmental pollutants via carbon footprints. Popular strategy to reduce cloud energy consumption is to understand the resource consuming characteristics of cloud workloads and execute them accordingly. However, a lack of precise understanding of such characteristics has restrained their efficiency in achieving sustainable datacentre execution and a generalised model of workload and user characteristics is largely missing. Achieving a maximum utilisation of minimal number of server resources is ideal both from an energy and revenue perspective. Addressing the lack of precise modelling of cloud workload characteristics, this project focuses on uncovering the yet unknown insights of cloud workloads and their execution trends and further develop intelligent models by leveraging Machine-Learning and Artificial Intelligence based techniques to process workloads in an energy-efficient way, ultimately to promote sustainable datacentres.  The methodology involves analysing large-scale real-world cloud trace logs with descriptive, predictive and prescriptive analytics using machine-learning, and deep-learning techniques. Furthermore, the insights of analytics will be utilised to develop an intelligent model that can aid in scheduling, task placement, and resource provisioning aspects of cloud workload execution with energy awareness.  Successful candidate will work within the School of Computing and Mathematical Sciences, and become a part of our Research Centre for Artificial Intelligence, Data Analytics and Modelling ([AIDAM](https://le.ac.uk/aidam)). The candidate will have opportunities for engaging with our industrial partners on potential opportunities. | | |

**References:**

1. J. Panneerselvam, L. Liu and N. Antonopoulos, An Approach to Optimise Resource Provision with Energy-awareness in Datacentres by Combating Task Heterogeneity, IEEE Transactions on Emerging Topics on Computing, 2018, doi: 10.1109/TETC.2018.2794328
2. Y. Lu, L. Liu, J. Panneerselvam, B. Yuan, J. Gu and N. Antonopoulos, A GRU-Based Prediction Framework for Intelligent Resource Management at Cloud Data Centres in the Age of 5G, IEEE Transactions on Cognitive Communications and Networking, 2019.
3. Y. Lu, L. Liu, J. Panneerselvam, X. Zhai, X. Sun, N. Antonopoulos, A Latency-based Analytic Approach to Forecast Cloud Workload Trend for Sustainable Datacentres, IEEE Transactions on Sustainable Computing, 2019.
4. J. Panneerselvam, L. Liu, Y. Lu and N. Antonopoulos, An Investigation into the Impacts of Task-level Behavioural Heterogeneity upon Energy Efficiency in Cloud Datacentres, Future Generation Computer Systems, vol. 83, pp. 239-249, June 2018, doi: https://doi.org/10.1016/j.future.2017.12.064
5. J. Panneerselvam, L. Liu and N. Antonopoulos, InOt-RePCoN: Forecasting User Behavioural trend in Large-Scale Cloud Environments, Future Generation Computer Systems, vol 80, pp. 322-341, March 2018. doi: https://doi.org/10.1016/j.future.2017.05.022
6. J. Panneerselvam, L. Liu, N. Antonopoulos and J. Hardy, Analysis, Modelling and Characterisation of Zombie Servers in Large-Scale Cloud Datacentres, IEEE Access Journal, vol 5, pp. 15040-15054, July 2017. doi: 10.1109/ACCESS.2017.2725898