**PhD Project Proposal**

School of Electronics, Electrical Engineering and Computer Science

& ECIT Global Research Institute

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| **Proposed Project Title: Hyper-dimensional random access with DNN-aided physical layer feature fusion** |
| **Principal Supervisor: Dr Youngwook Ko Second Supervisor:** |
| **Project Description:**  As intelligent connected applications (e.g., self-driving vehicles, vertical farm, UAV communications) grow with both complexity and population, a massive connectivity of randomly distributed Internet-of-Things (IoT) devices and UAVs is highly envisioned in various industrial applications, vertically converged with future wireless systems. Today’s random access technology in the majority of wireless standards (e.g., 3GPP’s NB-IoT, C-V2I, 5G-V2I) is predefined at the design stage and thus, suffers from lack of flexibility and low resilience to irregular deployment condition, different locations and time-varying wireless and interference environments.  This PhD programme is the first research work to propose a random access with machine learning aided physical layer feature fusion across the physical and multi-access layers, especially in ever-increasingly sophisticated and unpredictable wireless and interference conditions. For this, the project will develop new interdisciplinary research works that involve deep neural network (DNN) techniques and pre-coded random access technology in a hyper-dimensional space of randomly active devices. Irrespective of deployment surroundings and with various uncertainties, this project aims to identify and develop opportunities for automatically recognising multi-dimensional physical layer attributes and multi-access parameters. The developed opportunities will be explored for hyper-dimensional algorithms to select the most appropriate set of radio channels making a precision decision towards an automated random access in the massive connectivity at reduced complexity. |
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