ESR Project title: Intermittent computing for the extreme edge in beyond 5G networks [ESR9]

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Institution: KU Leuven, Belgium

Application deadline: May 31, 2021

ESR Project Description:

Extreme edge computing assumes that significant processing can run on the sensors. Ideally, extreme edge processing can exploit the energy harvested from the environment, which means that energy supply is irregular. Intermittent computing divides complex tasks in small steps that can be executed when there is just enough energy available. Intermediate results are then saved efficiently so that the sensors can go into a deep sleep state. When new energy is available, the sensor can wake-up and resume the processing. Interesting platforms are being proposed in the state of the art for adding deep learning acceleration on the sensors, such as Google's coral platform. Objectives are: (1) To study how much of the anomaly detection pipeline can run locally, and how many/much features/data should be communicated to the cloud for further processing there. (2) To co-design the local algorithms for various deep learning architectures, to make sure the algorithms match the chosen architectures optimally. A logical step is here for instance the use of quantized models. Beyond that, there also exist interesting approaches to achieve structured sparsity, and hence simpler models. (3) To divide the models into small parts that can be executed intermittently, while trading off memory access cost likelihood of losing intermediate results.

Expected Results:
(1) Light algorithms for local feature processing
(2) Intermittent strategies for deep learning
(3) Compute versus communicate trade-off exploration

Supervision and Mobility Program:
Once hired, the candidate:

▪ will work at KU Leuven, performing full-time research under the supervision of Prof. Sofie Pollin.

▪ will be enrolled in the PhD program at KU Leuven, under the supervision of Prof. Sofie Pollin.

▪ will additionally pursue two secondments at OULU and WSE, for a respective duration of 5 and 5 months.

Required, Preferred and Desired Skills:[1]

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[1] **Required**, means mandatory to pass the eligibility check. **Preferred**, means highly welcome and recommended. **Desired**, means additional, not strictly needed, but still very much appreciated.

- **Required:** At the time of recruitment, the applicant must not have lived in Belgium for more than 12 months in the previous 36 months (3 years).
- **Required:** No more than 4 years spent in research/work activities after the achievement of the MS degree.
- **Preferred:** A Master's degree in Telecommunications, Computer Science, Data Science or equivalent.
- **Preferred:** Very good communication skills in oral and written English.
- **Preferred:** Background in wireless communication and edge computing.
- **Preferred:** Open-mindedness, strong integration skills and team spirit.
- **Desired:** good command of the Python programming language.
- **Desired:** previous training MS-level training on machine learning techniques.