**Project title: Energy Consumption Optimization Studies for 5G Cellular Networks**

**Number of students** (minimum 2): 2-3

**Project duration** (1-6 months): 6 months

**Project frame** (Bachelor/Master, small project): Master

**Background:**

In relation to the worldwide development of mobile networks, the need for better mobile coverage is thereby followed by an increase in the deployment of base stations. This is due to the expansion of 4G/LTE technologies and to the upcoming deployment of 5G, which has sparked mobile operators to look for solutions for lowering the energy consumption in radio units. These are currently mostly based on semi-automated processes, such as disabling some of the network cells, typically in night hours. The scope of the mobile operators is to make these processes more automized by taking into consideration configuration parameters such as frequency, radio access technology (RAT) type, handover procedures etc.

Therefore, there are both economic and environment-related concerns that constitute the motivation for this study. One of the main environmental issues is related to how the energy consumption in cellular networks affects the increase/decrease of CO2 emissions, as explained in [1]. This project proposal is directed towards investigating and evaluating methods for developing an automatic process for energy saving in cellular networks. Basic data mining techniques [2] and dedicated market research are expected to be the baseline for the study. The goal is to prove that the chosen methods can contribute to an efficient business model for the operators in terms of both efficient network planning and cost savings, by lowering their Operational Expenditures (OpEx).

**The challenge:**

The view for this project is to pitch into the problem of 5G network planning and management from two perspectives: business and telecommunications/computer science. The challenge for the involved students is to perform a proof-of-concept analysis on network(s) consisting of 5G deployments.

The collaboration among the students must be oriented towards proposing methods for adapting the current planning and management of mobile networks to the future deployment of 5G technology:

* The first phase of the project consists of performing a case study analysis for power consumption trends in 5G scenarios;
* In the second phase the students will work on proposing and designing methods for power saving based on the analysis done in the first phase. The methods should consist of data models and data mining techniques for 5G network deployments. These would serve as 5G network model validation for the aforementioned case study, by approaching the problems from both a marketing and a technical point of view.

**The company:**

"2operate" <https://www.2operate.com/>

**Supervisor(s):**

Maria Stefan – main supervisor (ms@2operate.com)

José Gutierrez – co-supervisor (jg@2operate.com)

**Maria Stefan** works as Data Analyst for the company 2operate in Aalborg, Denmark. Her main field of interest is data analysis in the domains of telecommunications and smart grids. Before joining 2operate she completed her PhD studies at Aalborg University, in relation to data analytics for smart grids.

**Jose Gutierrez** is both CTO for 2operate and external lecturer at Aalborg University in the Department of Electronic Systems from Aalborg. His fields of interest include network planning and smart cities, and besides his technical work, he is an active promoter of Problem Based Learning (PBL) and active learning.

**Candidate background:**

* The candidates are required to have obtained a bachelor’s degree;
* One of the candidates should have the background in business/market analysis and development (i.e. knowledge of canvas analysis);
* The other one or two candidates should have basic knowledge in the area of Telecommunications (i.e. cellular and wireless mobile networks, LTE technology). Knowledge of 5G technology is a plus. It would be desirable that the telecommunications candidates have basic programming skills (Matlab, C#, C++ or Python).

# References

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| [1]  | greennets. [Online]. Available: http://www.greennets.eu/. |
| [2]  | ericsson.com, “Ericsson launches unique AI functionality to boost radio access networks,” October 2019. [Online]. Available: https://www.ericsson.com/en/news/2019/10/ericsson-ai-to-boost-ran. |