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Master Thesis –

ML-based resource allocation for power-saving V2X users

The **»Broadband & Broadcast«** (BB) department is active in the areas of mobile communications, satellite communications, Internet-of-Things and automotive communication systems. We take new concepts and algorithms from theory, implement them and test them in simulations and in prototypes in our labs and in the field. In short, the BB department establishes a bridge between communication theory and its employment in practice.

The following topic is also suitable for student projects, e.g. »Forschungspraktikum«, »Industrial Design Project« or similar.

Abstract:

Vehicle-to-everything (V2X) communication is not only about connecting the vehicles but also all road users such as pedestrians and cyclists. To this aim, all the road users should be able to choose radio resources in order to send their messages. 5G New Radio (NR) sidelink communication is the key enabler of V2X communication. In this project, we will look into the various radio resource allocation methods for all kinds of road users introduced by 3GPP for sidelink communication in mode 2 i.e. autonomous resource allocation and try to find the best method for different scenarios. The considered radio resource allocation methods for a UE in mode 2 of sidelink communication are full sensing, partial sensing, contiguous partial sensing, and random allocation. In 5G NR, we have also seen that the arriving traffic for the users can be periodic or aperiodic. In periodic cases, the periodicity can also be variable in time. Given this, we aim that the User Equipment (UE) in a network with a dynamic traffic flow to choose a resource allocation method to maximize energy efficiency and minimize the energy consumption simultaneously. Each UE should choose one of the methods of mode 2 resource allocation to maximize its revenue. When it comes to mathematical formulation, this problem is NP-hard and very time-consuming to solve. To this end, we aim to apply machine learning and in particular reinforcement learning methods to find the optimum policy for each scenario. The project will start with a literature review on existing work, then a machine learning solution should be developed, and finally the performance of the proposed solution should be evaluated by its comparison with the state-of-the-art.

What you will do

- You will study on radio resource allocations schemes for NR V2X.
- You design and develop a machine learning solution for resource allocation of power saving users in NR V2X.
- You develop of a simulation model to evaluate the performance of proposed solution.

What you bring to the table

- You are currently pursuing a degree in Computer Science or related field.
- You have a basic understanding of cellular networks, especially layer 1 and 2 protocols of NR.
- You possess good programming skills in python and MATLAB.
- You are interested in Machine Learning methods.

What you can expect

- **Flexible** working hours
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The thesis will be assigned and carried out in accordance with the rules of your university. For this reason, please discuss the thesis with a professor who can advise you over the course of the project.

The duration for the thesis should be 6 months and it can be started as soon as possible.

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Should any questions pertaining the thesis arise, please send a mail to your future supervisor Micheal Thomas (michael.thomas@ist.fraunhofer.de), citing the **ID number BBT-021**.

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Requisition Number: 59371 Application Deadline: none Location: Erlangen