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MASTER THESIS Anomaly detection in 5G beam propagation
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Detecting anomalies in 5G wireless communication

POPULAR SCIENCE SUMMARY **Katarina Hellgren, Phiphi Tran**

Advancements in today's technology have motivated invention of faster mobile communication systems. This project evaluates if and how machine learning can be used in order to improve connectivity and reduce energy consumption in the wireless communications system, 5G.

The fifth-generation mobile network, 5G, is the latest invention made by the third-generation partnership project (3GPP) and expects to both increase connection speed and reduce latency, which eventually will make it applicable in supporting state-of-the art technologies such as virtual reality and self-driving vehicles, among others. A major part of the 5G system is beam management which is the system that controls how signals, or beams, are assigned to user equipment's (UEs) such as phones and computers. Previous projects have looked at how machine learning could be used to improve beam management which has worked well. However, noise in the beams makes the algorithm unreliable at times and the signals unstable. We have thus applied machine learning to decrease the noise in the data, improving the performance of the beam management further. One of the machine learning algorithms we used was the method Density-based spatial clustering of applications with noise (DBSCAN) which clusters the data according to a mathematical model and leaves out the anomalies. Because the signals are distributed in space in a cluster-like fashion, we were able to use DBSCAN to detect signal anomalies. These results were then used to prevent UEs to connect to the outlier signals. We were able to reduce control signal overhead, that is, the amount of signal switches needed. They were in overall decreased, due to more stable properties of the inliers compared to the outliers. Connectivity was improved and an average increase in data transmission speed could be seen, confirming that avoiding outliers is preferred.