Internship Subject
Grid Coloring for Object Sensing and Localization

Internship Supervisors:

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Starting time: Position available immediately

Project Description

A robot moves on a grid or topology. At each position, it perceives the multiset of sensing of the tiles or surroundings that it covers. The goal of the project is to design and code an algorithm that labels the grid so that the robot can uniquely determine its location due to the combination of the sensed labels. The fewer the number of bits used to represent all the required labels for the system or network, the better. For example, in the following grid, no two 3-by-3 square contains the same multiset of the labels (we use color to illustrate, which however can mean an identification number or a few bits). We would propose interesting new mathematical models which may spur future scientific research. Interesting engineering application includes 6G wireless IoT systems.
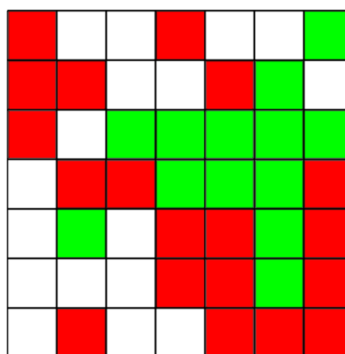
Skills that you will acquire: Combinatorics, number and coding method/theory, graph representation and discrete mathematics, algorithm design, programming and software implementation, machine learning and deep learning method, engineering practice and industrial experience.

Research methodology to be used: Several approaches of increasing sophistication can be applied. Greedy algorithm, algorithms improving a coloring of graph by solving local conflicts randomly, graph neural networks (as the problem is reminiscent of, but distinct from, graph coloring), machine learning and deep learning techniques.

Location:
To visit and conduct research collaborations at:
- INRIA Saclay, 1 rue Honoré d'Estienne d'Orves, 91120 Palaiseau, France
- Nokia Bell Labs, 12 Rue Jean Bart, 91300 Massy, France

The team:

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References

1. C. Adjih, C. S. Chen, C. S. Gobin, and I. Hmedoush, "Designing Medium Access Control Protocol Sequences Through Deep Reinforcement Learning," European Conference on Networks and Communications & 6G Summit, 2023.
2. Y. Shao, S. C. Liew and T. Wang, "AlphaSeq: Sequence Discovery with Deep Reinforcement Learning," IEEE Trans. on Neural Netw. & Learning Systems, 2020.
3. S.-W. Ho and C. S. Chen, "Visible Light Communication Based Positioning Using Color Sensor," IEEE 8th Optoelectronics Global Conference (OGC), 2023.
4. C. S. Chen, Y.-H. Lo, W. S. Wong, and Y. Zhang, "Object Tracking Using Multiset Color Coding," Preprint, 2024.