CONSCIENCE: Concrete for Sustainable Climate Neutral Construction and Engineering

Concrete is the most widely used material on earth after water. However, concrete production contributes to 8 - 10 % of global emission of greenhouse gases. With increasing infrastructure demands worldwide, reduction in CO2 emissions due to concrete production is essential for a sustainable future.

Problem definition
The development of new concrete mix designs with reduced CO2 emissions by e.g. the use of alternatives to Portland cement, recycled or waste materials is slow, expensive and inefficient when using traditional materials design approaches.

Description
Develop a data-driven computational ML-tool for identifying sustainable concrete compositions with characteristics such as performance (strength, stiffness etc.), availability and affordability that is at least equivalent to that of concrete. In addition, the tool shall generate region-specific low-carbon concrete compositions by esp. taking local resource availabilities into account. The identified concrete mix designs will be validated by production and testing in the concrete laboratory at TUM.

Key questions
- How to efficiently generate a complete dataset from existing literature and other data sources for training the ML model
- What state of the art Generative Algorithms from ML are optimal for this task
- What are the requirements for the ML tool to be extensible and modular

Links
https://www.mae.ed.tum.de/cbm/forschung/betontechnologie/

Skills
The module is open to Master/PhD students as well as interns; The 5-peson team is optimally comprised students with following background. 2 - ML, 1 - database, 1 Civil or Materials Engineer and 1 Chemist.

Partner
The Center for Building Materials at TU Munich is one of the leading research and testing institutes for building materials in Germany with around 110 employees. This challenge will be executed in close cooperation with members of the working group ,Concrete Technology‘ and ,Computational Modeling and Simulation‘.