Decision support for diagnosis of infectious diseases

This PhD project is part of a larger, multi-disciplinary, and collaborative effort between the Mathematics and Software Engineering departments at Chalmers, and the Infectious Diseases department at Sahlgrenska University, Östra. The projected outcome is a decision support tool that supports doctors IRL in making a series of diagnoses and treatment decisions for patients in the infectious disease ward. The diagnosis process primarily involves pattern recognition and clinical reasoning, and the system will need to integrate and combine a multitude of highly diverse data, and choose between a multitude of diagnoses and treatment plans. The support system will be used by physicians to support and shorten the time to correct diagnosis and to identify individual high-risk patients, and will be evaluated in a prospective study of standard clinical care.

This PhD project involves the development, implementation and assessment of a stochastic model that will serve as the core of the decision support system. The model will be based on Markov Decision Processes (MPDs) and reinforcement learning (RL), as they are efficient at identifying optimal decision policies over a wide variety of objectives, and transparent and interpretable in all their components, something that is crucial in health care.

The model development will include the exploration and further development of the various sub-branches and extensions of MPDs, as well as their related computational algorithms and approximations. The pilot system will be set to differentiate between sepsis (blood poisoning) and gastroenteritis/norovirus (winter vomiting flu), as these conditions often have a very similar onset, but are highly different both in treatment and severity, but the long-term goal is to include a multitude of diagnoses and treatments in the system.