Thesisvoorstel 1: Data mining of patterns in signals recorded from a bee hive

We have recently started recording large amounts of data from a beehive in Brussels in order to investigate whether we can detect patterns in this data that help us to both monitor the environment and the bee colony's health. The aim of the research is twofold: to investigate whether we can use the bees as remote environmental sensors and to investigate whether, through monitoring the colony's behavior, we can get advance warning of problems that may cause colony collapse (an increasingly worrying problem).
In order to do this we need to solve a number of challenging computer science problems.

This project aims to investigate, using data mining and signal processing techniques in what way environmental data (temperature, humidity, time of day, environmental noise) relates to and predicts data recorded from within the hive (sounds and temperature). This is a challenging problem, as there are large amounts of real-world noisy data, in which the patterns may not be stable over time (after all the bees' behavior changes with the season).
The student will need to apply signal processing techniques (these can be from a library) to mine for patterns selection of the recordings. Any techniques may be used here, but statistical machine learning techniques are probably most promising. When candidate patterns are found, these need to be tested with different selections of the recording in order to prevent spurious patterns from being found.

Thesisvoorstel 2: Counting bees on video recordings

We have recently started recording large amounts of data from a beehive in Brussels in order to investigate whether we can detect patterns in this data that help us to both monitor the environment and the bee colony's health. The aim of the research is twofold: to investigate whether we can use the bees as remote environmental sensors and to investigate whether, through monitoring the colony's behavior, we can get advance warning of problems that may cause colony collapse (an increasingly worrying problem).
In order to do this we need to solve a number of challenging computer science problems.

This project has the deceptively simple aim of counting the number of bees that pass through the image of a video camera that films the entrance of a bee hive. The number of bees that passes the entrance per unit time is an important indicator of the activity of a bee colony. The student is encouraged to solve this problem, for instance visual flow or feature-based approaches. However, it is important that the method is robust: it should work in any lighting condition (including ones where bees cast shadows) and even when bees collapse, or turn upside-down (which they do surprisingly often). The student should develop and fine tune their model using one subset of the available video recordings, and test its performance on different subsets. The performance will need to be compared to numbers established by counting manually.