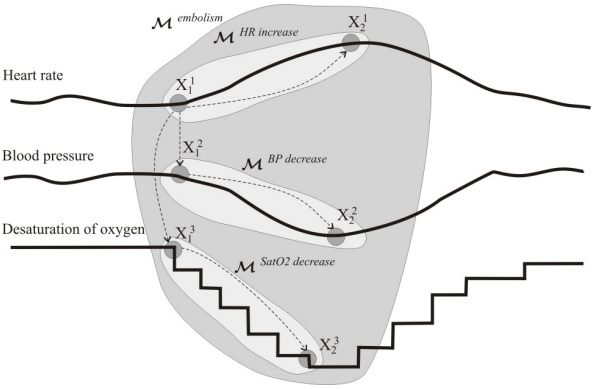
Structural techniques for pattern recognition start with a description of the pattern obtained directly from a human-being. That description is projected onto a computational representation which, after its validation, is used to identify the pattern.

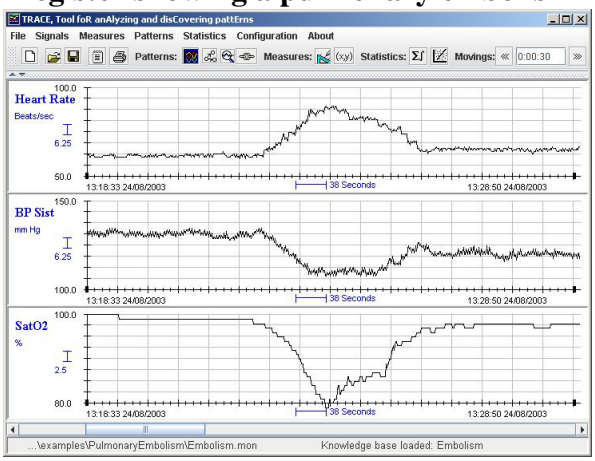
There are certain biological applications where a human expert is required to identify patterns in the domain application. For example, health care professionals who work in intensive care units are familiar with many signal patterns that occur over the physiological variables of patients and provide information about the patient's status.

Clinician's mental representation of an embolia



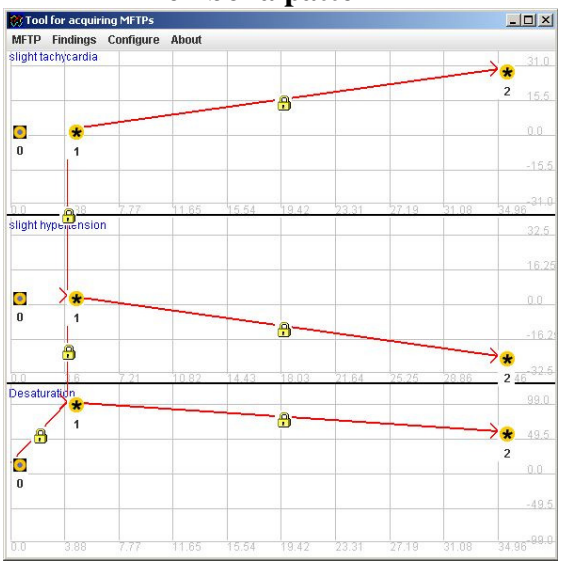
Thus, for example, if the heart rate of a patient increases slightly and, simultaneously, the blood pressure decreases, healthcare professionals know that an unexpected behavior is occurring over those parameters. If the heart beats faster, blood pressure should not decrease. This pattern could mean two things. The patient has a pulmonary embolism, that is, the venules in the lungs are being blocked by clots (in this case both events should occur simultaneously with a drop in oxygen saturation) or there is blood loss in the circulatory system – hemorrhage.

Register showing a pulmonary embolism



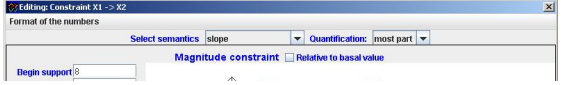
These kinds of patterns could be identified with any statistical pattern recognition technique. However, having a human expert that can describe the pattern allows the design of a pattern recognition technique that can be understood by human experts. Therefore, medical practitioners can edit the pattern and still have a reasonable amount of confidence that the pattern will work properly without the need to perform a validation.

TRACE's knowledge editor showing the embolia pattern



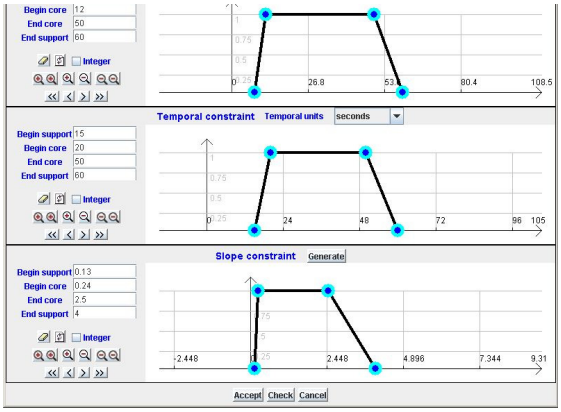
This fact is extremely useful in the medical domain, where the enormous physiological variability between patients forces the contextualization of the pattern for each monitoring task. In this setting, the statistical pattern recognition techniques cannot be applied because, neither is there a training data set nor is it possible for the health care professional to define new patterns based on those techniques.

Representation of the slight tachicardia funding



Furthermore, the pattern detection

technique uses a model of the pattern close to the mental model that the human expert has. Thus it is possible to provide detailed explanations about why a pattern has or hasn't occurred. For example, a pattern recognition system could explain that a certain pattern did not occur over a signal fragment because "both events that make up the patterns are too far away from each other" or "one of the increases is too small".



The major contribution to structural pattern recognition is the MFTP model which uses constraint networks to provide a computational representation of expert knowledge and fuzzy sets to represent and handle the imprecision and vagueness characteristics of human knowledge. This model has been implemented in the Tool for anAlyzing and disCovering pattErns (TRACE). The screen capture shown in this web page belongs to this tool.

TRACE showing the detection of the pulmonary embolism pattern