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Constraining Classification Results

Complex applications may demand for analyzing multiple sensor data, such as different camera views in videos, radar data, or similar.
Furthermore, the need for interpreting these data may aim at different classification tasks, e.g., one classifier shall regonize numbers, another colours, a further shall track objects in the same sequence of images.
Even furthermore, those classification results may need to be combined to fulfil given rules, e.g., all numbers in the whole video of each tracked object should be the same.
Hence, sensor data fusion and end-to-end approaches are not a solution because of different problem dimensions.
In this case, the results of multiple Machine Learning modules that classify data from different sensors in various ways have to be organized.
In this paper, we discuss an approach for gathering these results and continously formulating constraint problems and solving those with methods from Constraint Processing know from symbolic artificial intelligence (AI).
The approach defines interfaces for the output of classifieres, i.e., classes, object-ids, time, and spatial or other properties of detections, as well as a so called middle layer that transforms incoming detections into events consisting of constraint variables and constraint rules.
Those are then solved by a constraint system and a state-space search.
Hence, the result is a hybrid AI system that combines data-driven methods, such as Machine Learning, with knowledge-based methods, such as Constraint Processing. We demonstrate our approach in applications for high-level vision analysis of sport video streams.
However, the approach is general and can also be applied for interpretation tasks in natural science and other areas.

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