

Assignment 4

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1 Theory

1. Case-based reasoning is both a cognitive approach for modelling human behaviour, as well as an engineering approach for developing and implementing intelligent systems for problem solving. The philosophy of case-based reasoning is that "similar problems have similar solutions". The approach uses a collection of previously solved problems in what is called a case base. Classical machine learning approaches (regression, clustering, neural nets etc) does not take advantage of earlier solved cases. Instead, they generate relevant knowledge about the domain and classes there and then.
2. The approach has taken great inspiration of the cognitive procedures of the human mind. It lies in human nature to use situation specific experience knowledge when solving new problems. Reasoning by remembering is used to take inspiration from previous solutions, which is also an aspect that CBR takes advantage of.
3. Surface similarity is based on surface features and is applicable to different case representations using standard value types. An example could be the similarity between two cars, i.e which brand they are, what year they were produced, etc. Structural similarity is on the other hand more dependent on the case representation and uses domain knowledge to retrieve solutions. It is defined as the most common structure of cases and the modification rules needed to determine it. An example of structural similarity is using taxonomies to derive similarities.
4. When dealing with cases that are made up of attributes with heterogeneous characterization and query spaces, we have to take advantage of the general domain knowledge. The abstract nature of the cases demands knowledge-intensive case based reasoning. The role of the general domain knowledge is to enable a CBR system to reason with semantic and pragmatic criteria. The system models the general domain knowledge into semantic networks consisting of concepts and relations between them. The model represents the real life situation the system is to reason about. An example of a knowledge-intensive case based reasoning may be the model

of a car, with semantic concepts like the sub classes of a vehicle (van, car), the functions of the car (transportation), the parts of the car (engine, wheel, fuel system). The cases are then instances these concepts (which furthermore have concepts like status).

5. Knowledge can be distributed flexibly between containers. We have similarity measures, which is the retrieval of similarities between cases. Here one can use similarity functions to compute the distance between attributes of two instances. Furthermore, we have the Case base, which can be viewed upon as some sort of database of experience. Another container is the adaptation knowledge, which is used whenever the solution of a retrieved case has to be adapted for the current problem. Lastly, we have the vocabulary, which are what all the other knowledge containers are composed of (terms, attributes and concepts).