

Tutorial on CBR Frameworks

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In the past three decades of ICCBR, several CBR frameworks have been developed in several research groups. However, it is not easy, especially for young researchers, to know which CBR frameworks are being actively developed and what features they provide for their research. For this purpose, the ICCBR community will highly benefit from a tutorial in which the most prominent CBR frameworks will be presented in a short time and an overview of the framework features will be given. We, researchers and developers from four different universities, intend to give a tutorial for the CBR frameworks developed at our departments. For this purpose, the CBR frameworks CloodCBR, exit*CBR, myCBR, and ProCAKE will be presented in a tutorial and are shortly introduced in the following.

CloodCBR [1] is a case-based reasoning (CBR) framework that uses a microservices' architecture to enable the creation of distributed and highly scalable applications. CloodCBR is developed and maintained by the AI and Reasoning (AIR) group at Robert Gordon University, Aberdeen, UK. The framework features a variety of similarity measures for retrieval, such as ontology-based similarity and neural network language models. The tutorial will cover how to deploy CloodCBR in a developer-friendly manner using Docker, as well as how to create CBR applications, configure application options, and the facilities to support the CBR cycle (mainly the retrieval phase). Moreover, the tutorial will demonstrate how to integrate CloodCBR into other applications using its API and its extensibility for added functionality, e.g., custom adaptation or new similarity measures. The framework is implemented in Python and comes with an AngularJS-based client dashboard.

eXiT*CBR [2] is designed with the purpose of supporting the development of intelligent decision-making systems based on case-based reasoning (CBR). The aim of eXiT*CBR was to go further than a collection of methods to support CBR system development but to be a tool that supports experiment repetition and the interpretation of results by users, responding to the need of conducting a responsible research and innovation (RRI). Once the experiments fit the desired model for users, a running module can be generated and integrated into any other piece of software. eXiT*CBR has several versions, including a distributed approach, and allows the plugin of different modules to complement the different steps of CBR (as genetic algorithms for feature learning). The tool has been implemented in Java and applied mainly to Medicine and Healthcare (cancer prognosis, premature baby monitoring, insulin dose recommendation) but also in industry (fault detection, adjusting printing parameters).

myCBR [3] is a tool for developing CBR applications in Java. It has two main components: on the one side, the typical SDK for developers, which can be integrated into any given Java project by importing the SDK or the myCBR.jar file. On the other side, there is an additional tool called the “myCBR workbench”. This tool offers a graphical user interface, split into the ‘modeling’ and the ‘casebase’ view, which allows even non-programming affine people to rapidly create their own first CBR prototype. Using the SDK, any application can be made, such as mobile applications, web applications, or a typical Java project. myCBR has initially been developed by the Competence Center for Case-Based Reasoning, DFKI, Kaiserslautern, Germany, and the Centre for model-based software engineering and explanation-aware computing, University of West London, UK. The former, and the University of Hildesheim, Germany, are currently using, maintaining, and upgrading myCBR with further additional functionality, such as improved maintenance capabilities, additional knowledge representations, such as taxonomies, and explainability. Currently, the most common use cases are structured CBR applications using attribute-value pairs. Regarding the CBR cycle, Retrieve, Reuse and Retain are covered. Most prominently, the award-winning CookIIS application has been developed using myCBR. Additionally, an Intrusion Detection System using myCBR is presented on the main conference of ICCBR 2023.

ProCAKE [4] – the process-oriented case-based knowledge engine – is jointly developed by the Department of Business Information Systems II at the University of Trier and the Trier branch of the German Research Center for Artificial Intelligence (DFKI). It supports the first two phases of the CBR cycle, namely, Retrieve and Reuse. ProCAKE supports a wide range of case representations, such as textual and structural representations. It has a particular focus on process-oriented cases represented as semantic graphs. Several syntactic and semantic similarity measures are available for similarity assessment for various data types. In addition, it is also possible to develop custom data classes and corresponding similarity measures for retrieval. To support the adaptation of cases, a generic adaptation manager is provided with which own adaptation algorithms can be developed. The ProCAKE framework is written in Java, using XML for configuration and persistence. It has a pattern-driven architecture and relies heavily on interfaces and factories. ProCAKE has been used in many domains, e.g., for generating cooking recipes, supporting the modeling and execution of business and scientific workflows, or processing IoT sensor data from smart factories, and has received some prizes at the Computer Cooking Contest of ICCBR.

References

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