Explanation-aware Design of Mobile myCBR-based Applications

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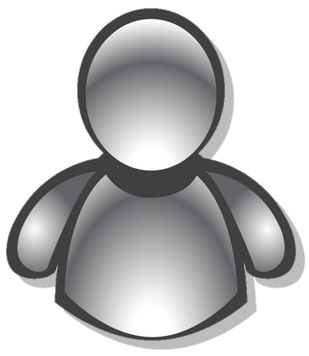
Our paper focuses on extending the explanation capabilities of the myCBR SDK as well as on the optimisation of the myCBR SDK in the context of android-based mobile application development. We examined the available knowledge for explanation generation within context-aware CBR systems. The need for the integration of new explanation capabilities was demonstrated by an Android-based context- and explanation-aware recommender application. Upon the experience gathered during implementation of the prototype a process for the integration of explanation capabilities into the myCBR SDK was introduced. Additionally, constraints and requirements for the integration of explanation capabilities into myCBR were introduced. Within this process we distinguished domain dependent and domain independent knowledge. We did this with regard to the different requirements for the integration of explanation capabilities into myCBR for the two types of knowledge.

Use case: A myCBR-based recommender system for the financial sector on a mobile device. In our scenario of the prototype application the recommendation process leads to detailed contracts. These contracts along with the information of the customer's attributes are used as cases to fill a case base. We distinguished two kinds of financial contracts: Life Insurance and Household Insurance.

Transparency: Explaining how a result the system provides was achieved.
Justification: Explaining why a result provided by the system is valid.
Relevance: Explain why an information is of importance.
Conceptualisation: Clarify the meaning of a term / concept to the user.
Learning: Enhancing either the users or systems domain knowledge.



Domain Knowledge formalisation

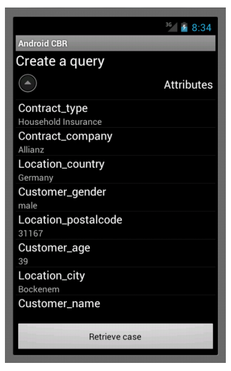
The application's design had to reflect the typical attributes of a financial contract. The case attributes and the amalgamation function chosen for a life insurance contract within the modelling view of the myCBR SDK:

Customer | Sim_life | Sim_household | Contract_type | Customer_gender

Type: Weighted Sum | Euclidean | Minimum | Maximum

Attribute	Discriminant	Weight	SMF
Contract_company	false	1.0	default function
Contract_premium	true	25.0	Sim_contract_premium_lifeinsurance
Contract_sum	true	25.0	Sim_contract_sum
Contract_type	true	155.0	Sim_contract_type
Customer_age	true	50.0	Sim_customer_age_life
Customer_gender	true	50.0	Sim_customer_gender_life
Customer_name	false	1.0	default function
Location_city	false	1.0	default function
Location_country	false	1.0	default function
Location_postalcode	false	1.0	Sim_location_postalcode_life

The weights we have chosen for the two amalgamation functions reflect the relevance of a given attribute for the overall retrieval as well as specify 'contract type' as a filter attribute to discern between life and household insurances.



Explaining the choice and weighting of the local similarities was the main goal of the prototypes explanatory capabilities.

The initial knowledge about life as well as household insurances was gathered from online offers available from websites of major banks. Based upon this raw knowledge the domain knowledge model was built.

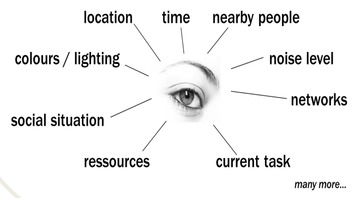
HSBC The world's local bank
Deutsche Bank
CRÉDIT AGRICOLE

Context data

Context knowledge is not integrated into myCBR but our prototype application we used context knowledge, given by the location of the user and his or her age and gender. This knowledge is automatically derived by the devices GPS sensor and retrieved from a user's social context. The location is of importance for the household insurance contract and the age and gender of the user is of importance for a life insurance contract of the user.

Location context: GPS is used to establish the users location. This information is relevant for household insurances only.

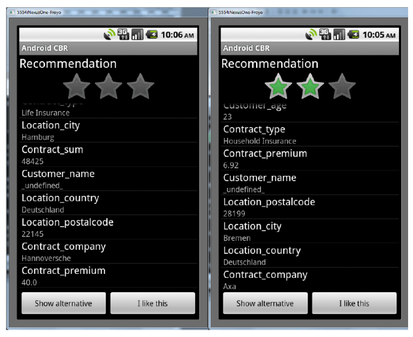
Social context: A users social network context (the users profile information) is used to establish the users gender and age. This information is relevant for life insurances.

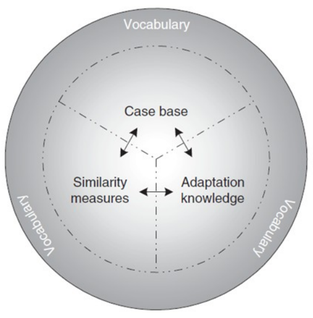


Context and explanation: Also many explanations can be derived from context knowledge and vice versa contexts can be derived from explanatory knowledge, we excluded this possibility from our prototype for the time being.

CBR knowledge formalisation providing explanatory knowledge

Use of domain independent knowledge: Domain independent explanations can be derived from the structure of the knowledge representation used within the knowledge containers. We exploit these formalisation approaches to derive functionalities to provide domain independent explanations for the myCBR SDK.



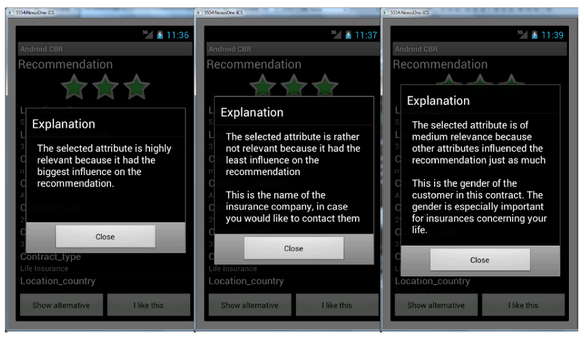


Use of similarity measures as explanatory knowledge: similarity measures play an important role as they ultimately determine the result of the retrieval and therefore have to be the first choice in this case study to provide explanations.

Use of the Vocabulary as explanatory knowledge: In the vocabulary the domain knowledge is modelled in inheritance or decomposition structures. These structures allow, e.g., for purpose explanations of attributes. Furthermore the vocabulary offers insight into the actual data types thus providing transparency for allowed values.

myCBR

Using domain specific knowledge as explanatory knowledge



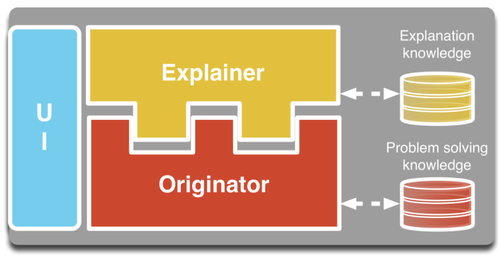
Aside from the possibility to generate explanations from the already present domain independent knowledge there is a need to provide further, **domain specific explanation** knowledge. Such knowledge is needed to generate the following kinds of explanations: Justifications, explanations describing domain specific dependencies and explanations based on context knowledge.

Possible explanations generated from domain specific knowledge:

Static explanations are aiming at providing the knowledge engineer with the means to explain to the user design decisions and domain specific knowledge modelling decisions.

Dynamic explanation capabilities are aiming at enhancing the user interaction with the CBR application. An example for such an interactive explanation capability is to use critiquing to suggest the next most relevant attribute to the user as this technique poses a well established approach.

Android CBR



Process of Integrating new Explanation Capabilities into the SDK

- **Step 1**: Constraints regarding the explanation capability to add to the SDK have to be taken into account. These constraints are: Availability of the knowledge, computational costs and usefulness on generic level.
- **Step 2**: If a new explanation capability is conforming to all constraints it has to be implemented in a prototypical way for testing and evaluating with regard to the mentioned constraints.
- **Step 3**: Once the prototypical implementation of the new explanation capability is established: The knowledge it uses has to be abstracted to allow for frequent reuse of the new capability. This is done by decoupling it from the domain specific knowledge. This step is not necessary for new domain independent explanation capabilities relying on the knowledge formalisation within the knowledge containers
- **Step 4**: If the developer has created an abstracted form of his tested new explanation capability, she has to provide new means of storing and accessing the domain specific explanatory knowledge within the SDK. For domain independent explanation capabilities the SDK developer has to establish if the problem solver (the CBR system) provides the necessary knowledge.
- **Step 5**: Provide the necessary additional GUI functionalities for the knowledge engineer so that she can incorporate the domain specific knowledge into the CBR system she designs in the myCBR Workbench.

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