On Explanation

-Supporting the Use of Complex Information Systems -

Dr. Thomas Roth-Berghofer, Senior Researcher German Research Center for Artificial Intelligence DFKI GmbH Interner Workshop November 23, 2007, Kaiserslautern, Germany



User

Current activities in several projects







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Quotes from the symposium

- Knowledge is something that can be used for answering certain questions." (Prof. Yingxi Zhong)
- "Systems must adapt to us humans.", "We have to learn more about human systems.", "People have different background, different velocity of learning, different preferences" (Prof. Klaus Mainzer)
- ,... human-computer interaction = human-human interaction" (Prof. Elisabeth André)

Quotes from Nepomuk prototype usability evaluation results

- The users want to know why things happen; "Why does the computer show me this document?"
- They also want to affect what the computer does for them; "How can I tell the compute that I don't want ..."
- People like to be in control of what happens.

1991: Seminar on case-based reasoning Chapter 1

First contact with "Casebased explanations" and David B. Leake's work

Co-Chair of Explanation-aware Computing workshops

Fallbasiertes Erklären

Thomas Berghofer

Erklärungsbasiertes Lernen (explanation-based learning, kurz EBL) ist eine mächtige Methode zur Einordnung von Information. Da die zugehörigen Algorithmen auf gute Erklärungen angewiesen sind, müssen diese auf effiziente Weise konstruiert werden. Erst recht wenn diese auf die reale Welt Bezug nehmen, in der vollständige und genaue Informationen selten verfügbar bzw. möglich sind.

Menschen versuchen sich in neuen Situationen an bereits Erlebtem zu orientiern. Dies ist der Kernpunkt dieses Ansatzes.

Neue Erklärungen aus alten aufzubauen hängt vollkommen davon ab, daßbereits Erklärungen im Speicher verfügbar sind. Zur Beschreibung von Erklärungen werden explanation patterns eingeführt. Als Beispiel für eine Implementierung dient das System SWALE.

Übersicht

1997: Diploma thesis

"Explanation-based learning of control information from failures in (action) planning"

Diplomarbeit

Erklärungsbasiertes Lernen von Kontrollinformationen aus Fehlschlägen bei der Planung

Thomas Roth-Berghofer

Juli 1996

1997–2002: CBRWorks and orenge

Simple explanations of similarity calculations in CBRWorks

Explanation of recognized concepts in textual CBR part of orenge



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2004: Explanation of confidence calculation

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What do we do when we have problems following a conversation?

Then we ...

- Ask about the concepts we do not understand Request justifications for some fact or line of argumentation Ask about functions or purposes of used concepts
- Ask about motivation of conversation partner or how a conclusion was reached
- Ask about our conversation partner's confidence in some fact or line of reasoning

When was the last time you "asked" an information system such questions?





"Trust me. I know what I am doing!" Sledge Hammer



"Trust me. I know what I am doing!" Sledge Hammer





Explanation participants





Explanation participants



Explanation participants



Research questions

Necessary knowledge What does the explainer need to know for generating explanations? What can and what does the orginator need to provide?

Explanation-enabled/-aware architecture

Methodology How to build an explanation-aware information system

Explainer

Originator

Overview

General explanation characteristics
 Explanations from an information point of view
 Example projects:

 Nepomuk – The Social Semantic Desktop
 myCBR



What are explanations?

What are explanations?

Explanations are answers to questions.

When are questions being asked?



When are questions being asked?

Whenever expectations are not met.

What must be explained?

Humans explain ...

The physical world, i.e., how things work
The social world, i.e., how societies work
Individual patterns of behaviour, i.e., how individuals work



R. C. Schank. Explanation Patterns: Understanding Mechanically and Creatively. Lawrence Erlbaum Associates, Hillsdale, NJ, 1986.

What are good explanations?

- Short and easy to overlook
- Innovative
- Relevant
- Convincing
- Different perspectives and follow-up questions
- Natural



W. R. Swartout and J. D. Moore. Explanation in second generation expert systems. In J. David, J. Krivine, and R. Simmons, editors, Second Generation Expert Systems, pages 543-585, Berlin, 1993. Springer Verlag.

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determined by contextdependent criteria

Explanations can be viewed as a kind of information.

"The train to Kaiserslautern leaves Lugano at 13:55 h."

"The train to Kaiserslautern leaves Lugano at 13:55 h."

Truth

"The train to Kaiserslautern leaves Lugano at 13:55 h."

Truth Understanding

"The train to Kaiserslautern leaves Lugano at 13:55 h."

Truth Understanding Utility

"The train to Kaiserslautern leaves Lugano at 13:55 h." Truth Understanding Utility Storage and retrieval

"The train to Kaiserslautern leaves Lugano at 13:55 h."

Truth Understanding Utility Storage and retrieval Information generation

Participants in travel booking scenario



Explainer

Originator

TravelService - Your timetable

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TravelService - Your timeta.

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Surf&Rail. Jede Woche 30 Top-Verbindungen ab 39,- EUR.

bahn.de | Preise&Angebote | Planen&Buchen | Mobilität&Service | Reisebüro | Internat. Guests | Konzern

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information and bookings in the majon Kaiserstautern



Explainer

Originator
Explanation dimensions

Cognitive aspects of explanations

Explanations are the most common method used by humans to support decision making." (Schank, 1986) Main purpose: Explain a solution. How was the solution derived? How does a system work?

How to handle a system

Explain failures.

Cognitive aspects of explanations

- "Explanations are the most common method used by humans to support decision making." (Schank, 1986)
- Main purpose: Explain a solution. How was the solution derived? How does a system work? How to handle a system Explain failures.

- document?"
- l don't want ..."

Nepomuk evaluation results

The users want to know **why** things happen; "Why does the computer show me this

They also want to **affect** what the computer does for them; "How can I tell the compute that

People like to **be in control** of what happens.

Computational aspects

Backward explanations: Explain the result and how it was obtained. Forward explanations: Explain (indirectly) by showing different ways to further optimize a given result.

Open up possibilities for exploratory use.





Backward explanations

explanations



Forward and backward



Personal Semantic Web: a semantically enlarged intimate supplement to memory

Social protocols and distributed search

NEPOMUK enabled peers

Personal Information Model PIMO



Articulate and link concepts with relations



Articulate and link concepts with relations

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 - Seminar
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 - Fallbasiertes Schließen (V) WSOE
 - Semantic Web

Semantic Web

Fallbasiertes Schließen (V) WS06

How can we support knowledge articulation?



Building your personal semantic web







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⊨ • ∲ <mark>Posteingang</mark> -- ∲ Private -- ∲ Project Semantic Desktop -- ∲ Work







Rebirth example: PIMO person

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Rebirth example: PIMO person

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Import and rebirth process: Schematic overview



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	🔝 Max Mustermann	muster@standard.de				
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5 matches found						



from crawl reports





Gnowsis Ontologies Crawl Report Database Admin Debug Sync

Provenance Explanations

This explanation describes the import/creation process of the PIMO item "JohnDoe".

"JohnDoe" is a Person in PIMO, because the data source it has been crawled from is an address book.

"JohnDoe" has been crawled from:

DataSource	Started	Finished	New Objects	Deleted Objects	Modified Objects	Not Modified Objects	
"Address Book" (http://aperture.semanticdesktop.org/ ontology/source#AddressbookDataSource)	"2007-03- 05T14:17:11"	"2007-03- 05T14:17:11"	"3"	NULL	NULL	"1"	<u>view</u> <u>details</u>

An address book entry describes features of a person. Only the primary e-mail address is used at the moment to identify the person, other information is not used. An import of an address book entry is transformed into an instance of the PIMO class "Person".



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Status and plans

- Markus Eppert (graduate student) developed first prototype for basic provenance explanations of crawled and reborn addressbook entries.
- Follow-up diploma thesis: "Design and development of a generic explanation component for the rebirth machine"
- Florian Mittag (graduate student) develops a decision tracking component on top of a Justification-based Truth Maintenance system.

Explanations in myCBR



Case-Based Reasoning (CBR) is ...

A problem solving approach:

New problems are solved based on the solutions of similar past problems.

Basic assumption:

Similar problems have similar solutions.

Typical examples

- An auto mechanic who fixes an engine by recalling another car that exhibited similar symptoms is using case-based reasoning.
- A lawyer who advocates a particular outcome in a trial based on legal precedents or a judge who creates case law is using case-based reasoning.
- In e-commerce scenarios: Similarity-based product retrieval and recommendation.

Typical examples

- An auto mechanic who fixes an engine by recalling another car that exhibited similar symptoms is using case-based reasoning.
- A lawyer who advocates a particular outcome in a trial based on legal precedents or a judge who creates case law is using case-based reasoning.
- In e-commerce scenarios: Similarity-based product retrieval and recommendation.

Traditional view

Reuse Revise Agnar Aamodt and Enric Plaza. Case-based reasoning: Foundational issues, methodological variations, and system approaches. AI Communications, 7(1):39-59, 1994.



Retrieve:

Given a target problem, retrieve cases from memory that are relevant to solving it.

CUICO

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Reuse:

Map the solution from the previous case to the target problem.

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Revise:

Test the new solution, revise if necessary.

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Retain:

After the solution has been successfully adapted to the target problem, store the resulting experience as a new case in memory.

Retrieve:

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Map the solution from the previous case to the target problem.

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Retain:

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Knowledge containers

Concept introduced by M. M. Richter (in 1995) Contain and structure the knowledge of a CBR system Collection of knowledge that is relevant to many tasks Knowledge containers in rule-based systems: Facts Rules

> M. Lenz, B. Bartsch-Spörl, H.-D. Burkhard, and S. Wess, editors. Case-Based Reasoning Technology: From Foundations to Applications. LNAI. Springer-Verlag, Berlin, 1998.

Knowledge Containers

× Vocabulary

Structure of the domain schema, e.g., classes, attributes, allowed values Basis for the three other knowledge containers

Similarity measures

define how the most useful cases are retrieved define by what means the similarity is calculated

Solution transformation (or adaptation) knowledge

covers the knowledge for translating prior solutions to fit a given query

Case base

stores the experience of the CBR system in the form of cases

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stores the experience of the CBR system in the form of cases
(some) myCBR features

Plugin for popular ontology editor Protégé (Version 3.x) Extensions provided by myCBR (current Version 2.0 beta): Easy import of raw data (csv-files) GUIs for modelling knowledge-intensive similarity measures Similarity-based retrieval functionality Export of domain model and similarity measures in XML format Stand-alone retrieval engine for separate use / integration More information and download: <a><u>http://mycbr-project.net</u>



Comparing features



Body

- Model

Color

Mileage



Class "Car"

		Slots	Forms	Instances	Similarity	Modeling	CBR
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		Color	single	Symbol		allowed-va	lues=
		Doors	single	Integer		minimum=	2, ma
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		Gas	single	Symbol		allowed-va	lues=
		Manufacturer	single	Symbol		allowed-va	lues=
		Miles	single	Integer		minimum=	0, ma
		Model	single	Symbol		allowed-va	lues=
		Power	single	Integer		minimum=	10, m
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s={anthracite black blue dark blue dark grav	
maximum=7	
s={ABS,ESP,Navigation}	
s={diesel,gasoline}	
s={audi,bmw,mercedes-benz,vw}	
maximum=1000000	
s={316i,318i,320i,323i,325td,325tds,328i,5	
maximum=1000	
maximum=1000000	
0. maximum=300	
50.0, maximum=2007.0	
maximum=9	

Name	Documentation	Constrai
Car		
Role		
Concrete	•	

Template Slots

Name	Cardinality	Туре	Other Face
Body	single	Symbol	allowed-values={convertible,coupe
Car Code	single	Integer	minimum=0, maximum=1000000
CCM	single	Integer	minimum=1000, maximum=6000
Color	single	Symbol	allowed-values={anthracite,black,b
Doors	single	Integer	minimum=2, maximum=7
Extras	multiple	Symbol	allowed-values={ABS,ESP,Navigation
Gas Gas	single	Symbol	allowed-values={diesel,gasoline}
 Manufacturer 	single	Symbol	allowed-values={audi,bmw,merced
Miles	single	Integer	minimum=0, maximum=1000000
Model	single	Symbol	allowed-values={316i,318i,320i,3
Power	single	Integer	minimum=10, maximum=1000
Price	single	Integer	minimum=1, maximum=1000000
Sound	single	Instance of Soundsystem	
Speed	single	Integer	minimum=100, maximum=300
Year	single	Float	minimum=1950.0, maximum=200
ZIP	single	Integer	minimum=0, maximum=9





Name	Documentation	Constrai
Car		
Role		
Concrete	•	

Template Slots

(Name	Cardinality	Туре	Other Face
	Body	single	Symbol	allowed-values={convertible,coup
	Car Code	single	Integer	minimum=0, maximum=1000000
l	CCM	single	Integer	minimum=1000, maximum=6000
	Color	single	Symbol	allowed-values={anthracite,black,
l	Doors	single	Integer	minimum=2, maximum=7
l	Extras	multiple	Symbol	allowed-values={ABS,ESP,Navigation
l	🗖 Gas	single	Symbol	allowed-values={diesel,gasoline}
	 Manufacturer 	single	Symbol	allowed-values={audi,bmw,merce
	Miles	single	Integer	minimum=0, maximum=1000000
	Model	single	Symbol	allowed-values={316i,318i,320i,3
l	Power	single	Integer	minimum=10, maximum=1000
	Price	single	Integer	minimum=1, maximum=1000000
l	Sound	single	Instance of Soundsystem	
l	Speed	single	Integer	minimum=100, maximum=300
	Year	single	Float	minimum=1950.0, maximum=20
	ZIP	single	Integer	minimum=0, maximum=9





Name	Documentation	Constrai
Car		
Role		
Concrete	•	

Template Slots

Name	Cardinality	Туре	Other Face
Body	single	Symbol	allowed-values={convertible,coupe
Car Code	single	Integer	minimum=0, maximum=1000000
CCM	single	Integer	minimum=1000, maximum=6000
Color	single	Symbol	allowed-values={anthracite,black,b
Doors	single	Integer	minimum=2, maximum=7
Extras	multiple	Symbol	allowed-values={ABS,ESP,Navigation
Gas Gas	single	Symbol	allowed-values={diesel,gasoline}
Manufacturer	single	Symbol	allowed-values={audi,bmw,merced
Miles	single	Integer	minimum=0, maximum=1000000
Model	single	Symbol	allowed-values={316i,318i,320i,3
Power	single	Integer	minimum=10, maximum=1000
Price	single	Integer	minimum=1, maximum=1000000
Sound	single	Instance of Soundsystem	
Speed	single	Integer	minimum=100, maximum=300
💻 Year	single	Float	minimum=1950.0, maximum=20
ZIP	single	Integer	minimum=0, maximum=9





Car instances



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₽∎∎	3333233		
	1251533		
	8233233		
	3333333		
	66666666		
	11111		

Car instances

INSTANCE BROWSER	INSTANCE EDITOR	۱		
For Class: 🔵 Car	For Instance: ♦ 1	00 (instance of C	ar)	
₽ ¥ * *	Car Code	CCM	Year	Body
♦ 10	100	3000	1996.0	sedan 🛟
100				
101	Doors	Miles	Color	Gas
102	4	18146	yellow 🛟	diesel 🛟
103		1		
104	Power	Price	Manufacturer	Model
105	176	58499	mercedes	e_300_die 🛟
106				
107	Speed	ZIP		
108	224	3		
109		5		
♦ 11				
♦ II				
♦ 109	575			



Global similarity measure

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	u 🗹 🛩 🍉	protégé
CLASS BROWSER For Project: autos Class Hierarch SVSTEM-CLASS Car Soundsystem Car Slot BROWSER For Project: Cas Car	asses ■ Slots ■ Forms ◆ Instances Similarity Modeling CBR Retrie SIMILARITY MEASURE FUNCTIONS Available functions CarFunc New Duplicate Delete Active Attributes (Slots): Attributes (Slots): Attribute discriminant weight Body CCM Car Code Color Doors Gas Manufacturer Miles Model Power Price Speed Year ZIP Extras Sound	eval
 Body Manufacturer CCM Car Code Price Speed ØB 	cannot inherit!	 Weighted Sum Minimum Euclidean Maximum

 Feature match: local similarity measures

Class similarity: aggregate local similarities

Weighted sum Maximum Minimum Euclidian distance

Global similarity measure

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	u 🕹 🖊 🗣		< protégé
	lasses Slots = Forms + Instances	Similarity Modeling CBR Retrieval	
CLASS BROWSER For Project: autos Class Hierarch SYSTEM-CLASS Car Sound system Car Sound system SLOT BROWSER For Project: autos Slot Hierarchy Gas Power Model Doors ZIP Sound Color Extras Year 	SIMILARITY MEASURE FUNCTIONS Available functions CarFunc Attributes (Slots): attribute discriminan Body CCM Car Code Color Doors Gas Manufacturer Miles Model Power Price Speed Year ZIP Extras Sound	Vew Duplicate elete Active 1 1 1 1 1 1 1 1 1 1 1 1 1	comment
 Body Manufacturer CCM Car Code Price 			
Speed 💽	Cannot Inherit!	• Weighted O Euclidear	n O Maximum

Feature match: local similarity measures

Class similarity: aggregate local similarities

> Weighted sum Maximum Minimum Euclidian distance

Important attributes

Attributes (Slots):

attribute	discriminant	wei
Manufacturer	\checkmark	7 Activ Car manufacturer
Price	\checkmark	7 Activ Basis for negotiation
Body	\checkmark	5 Activ Car body
Color	\checkmark	5 Activ Car color
Model	\checkmark	5 Activ Car model
Miles	\checkmark	3 Activ Mileage
Power	\checkmark	3 Activ Horse power
Doors	\checkmark	2 Activ Number of doors
CCM	\checkmark	1 Activ Cylinder capacity
Car Code		1 Activ Identifier; not used for retrieval
Gas	\checkmark	1 Activ Type of fuel
Speed	\checkmark	1 Activ Top speed
Year	\checkmark	1 Activ Year of production
ZIP		 Activ Area of seller (first digit; Germany); no
ZIP		1



Local

similari	ties: Car body	y
 e → autos Protégé 3.1.1 (file:/ c → □ → □ → □ → □ → □ → □ → □ → □ → □ →	Users/roth/Documents/workspace/mycbr/distribution/samples/auto_set/au asses Slots Forms Instances Similarity Modeling CBR	ntos.pprj, Protégé Files (.pont and .pins)) protégé Retrieval
CLASS BROWSER For Project: autos Class Hierarch For Project: Class Hierarch Stream Project: Class Hierarch Stream Project: Class Hierarch Stream Project: Stream Projec	SIMILARITY MEASURE FUNCTIONS -Available functions BodyFunc Delete Active	
Car Soundsystem	Similarity mode: Table Symmetry: Symmetric asymmetric Case Base Values Reset convertible coupe fastback roadst	? ? ter sedan station_wagon
SLOT BROWSER For Project: autos Slot Hierarchy Power	convertible 1.0 0.0 0.2 0.7 coupe 0.0 1.0 0.2 0.0 fastback 0.2 0.2 1.0 0.5 roadster 0.7 0.0 0.5 1.0 sedan 0.0 0.7 0.0 0.0 station_w 0.0 0.5 0.0 0.0	0.0 0.0 0.7 0.5 0.0 0.0 0.0 0.0 1.0 0.8 0.8 q='roadster', c='sedan'
Model Doors ZIP Sound Color	ery Values	
 Extras Year Body Manufacturer CCM Car Code Price 	ð	
Speed Miles		

Local similarities: Car body

	autos Protégé 3.1.1 (fi	le:/Users/roth/Docum	ents/workspa	ace/mycbr/distr	ibution/samples/auto	_set/aut	os.pprj, Protégé
DB		2 4 4 4					
		Classes Slots	E Forms	Instances	Similarity Modeling	CBR F	Retrieval
CLASS B	ROWSER	SIMILARITY MEAS	URE FUNCTIO	ONS			
For Proj	ect: 🛡 autos	-Available function	s				
Class Hi	erarch 🔏 😭 👻 💌 🔻	BodyFunc			New Duplicate		
O :THING	G	-		D	elete Active	-	
► 0 :SY	STEM-CLASS						
O Ca	r	Similarity mode:	Table	†			
500	undsystem						
		_		_		Ca	ise Base
	Reset	convert	ible	C	oupe		fastbac
SLO1	convertible	1.0		0.0		0.2	
For P	coupe	0.0		1.0		0.2	
Slot I	fastback	0.2		0.2		1.0	
	roadster	0.7		0.0		0.5	
	sedan	0.0		0.7		0.0	
	station_w	0.0		0.5		0.0	
Bo	ar dv						
Ma	nufacturer						
= cc	M .						
Ca Pri	r Code						
= Sp	eed						
Mil	es 🗸						
	- 88						
<u>e</u>						_	
A COLOR OF THE OWNER							



Local similarities: Car model

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	u ∠i <> ▶	
C	lasses Slots = Forms + Instances Similarity Modeling	CBR Retrieval
CLASS BROWSER	SIMILARITY MEASURE FUNCTIONS	
For Project: autos	Available functions	
	ModelFunc New Duplicat	e
SYSTEM-CLASS		
• Car	Similarity mode: Taxonomy	
Soundsystem	Similarity mode.	
	Symmetry: 💿 symmetric 🔘 asymmetric	
		🔻 🧊 Model
	Inner nodes ves ?	📁 golf
SLOT BROWSER	as values O no O no	j⊒ m3
For Project: autos		m_roads
Clat History	Camentic of Case	▼ 2 3_series [0.5]
Gas	inner nodes o any_value o any_value ?	ji 320i
Power	O uncertain	ji 323i
Model		225td
Doors		225tas
= ZIP	Semantic of pessimistic pessimistic ?	i 328i
Sound		ji 316i
Extras	O average	[0.5]
Year		▶ 📁 a_class (0.5)
Body		C_class [0.5]
Manufacturer		e_class [0.5]
CCM		Series [0.1]
Car Code		
Speed		



Local similarities: Car model

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	≥ 2 4 4		📁 🧊 g
	Classes Slots	s = Forms + Instances Similarity Modeling	河 n
CLASS BROWSER	SIMILARITY ME	ASURE FUNCTIONS	(iii) m
For Project: 🕈 autos	Available functi	ons	
Class Hierarch 🔏 ¥ 💥 💌	ModelFunc	New Duplicate	📁 р
• :THING		Delete Active	V 🕅 3
Car	Similarity mod	le: Taxonomy	
Soundsystem		0	<u>v</u>
	Symmetry:	💌 symmetric 🔘 asymmetric	<u>(</u>
88		query case	G
	as values	• yes • yes ?	
For Project: • autos		o no	
Slot Hierarchy	Semantic of	query case	C C
Gas	inner nodes	• any_value • any_value	i i
Power Model			<u> </u>
Doors	Competing of	query case	6
ZIP Sound	uncertain	O optimistic O optimistic ?	► 100 E
Color		🔿 average	
Extras Year			🕨 🕨 📁 a
Body			
Manufacturer			
Car Code			🕨 🕨 📁 e
Price			Z 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
Speed			
			🕨 🍋 S
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- n_roads...
- assat
- _series [0.5]
- ili 320i
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- 🧵 325tds
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- _series [0.5]
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- _class [0.5]
- 3_series [0.5]
- k [0.5]

Local similarities: Cylinder capacity

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• • •	Classes Slots Forms Instances Similarity Modeling CBR Retrieval
CLASS BROWSER	SIMILARITY MEASURE FUNCTIONS
For Project: 🕈 autos	Available functions
	CCMFunc New Duplicate
 SYSTEM-CLASS 	
• Car	Similarity mode: Advanced
Soundsystem	Similarity mode.
	Symmetry: 🔘 symmetric 💿 asymmetric
	Basic Similarity Points Additional Similarity Points
88	Distance Similarity 2
SLOT BROWSER	Min 0.8
For Project: • autos	0 1.0
Slot Hierarchy	Max 0.0
Gas	
Power	query < case
Model	
Doors	
Sound	0.75
Color	
Extras	
🔲 Year	0.5
Body	
Manufacturer	
Car Code	0.25
Price	
88	-5000 -3761 -2507 -1254 0 1239 2493



Local similarities: Cylinder capacity

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• • •	lasses Slots E Forms Instances Similarity Modeling CBR Retrieval
CLASS BROWSER	SIMILARITY MEASURE FUNCTIONS
For Project: autos	Available functions
	CCMFunc New Duplicate
Class Hierarch	
SYSTEM-CLASS	Delete Active
• Car	Similarity modes Advanced
Soundsystem	Similarity mode: Advanced
	Symmetry: 🔘 symmetric 💽 asymmetric
	Basic Similarity Points
88	
	Distance Similarity ? Distance Simila
SLOT BROWSER	Min 0.8
ror Project. • autos	Max 0.0
Slot Hierarchy 🔒 🗮 🗙	
= Gas	query < case
Power	1.0
Doors	
= ZIP	
Sound	0.75
Color	
Extras	
Year	0.5
Body	
= Car Code	0.25
Price	
88	-5000 -3761 -2507 -1254 0 1239 2493



myCBR Retrieval Tab

DETAILS AND QUERY

Car	Reset Query	Query from Case	Start Retriev
Reset	Query	731 1 [1,00]	128 1 [0,99]
Gas Power Model Doors ZIP Color + Extras Year Body Manufact CCM Car Code Price Speed Miles Box_amo Receiver Bass Box_Brand + CDPlayer	diesel 176 e_300_diesel 4 3 yellow Navigation 1996.0 sedan mercedes-benz 3000 100 58499 224 18146 <<_ UNDEFINED _>> <<_ UNDEFINED _>> <<_ UNDEFINED _>> <<_ UNDEFINED _>> <<_ UNDEFINED _>>		

+ CDPlayer << UNDEFINED >>



Query



SAECI << " UNDERINED ">>>

🖯 🖯 🖯 auto	os Protégé 3.1.1 (file:/User	rs/roth/Documents/workspac	ce/mycbr/distribution/sampl	es/auto_set/autos.pprj, Protég	é Files (.po	nt and .pir	ns))	
	of 🗈 🛱 💥 🛍 🛛	4 4 4				<	Ø pro	tégé
	- Cla	asses Slots E Forms	s 🔶 Instances Similarit	y Modeling CBR Retrieval				
					QUERY RE	SULTS		
					r	Case Name	Sim	
Car	Reset Query) (Query from Case	Start Retrieval	$) (\langle \rangle (\rangle)$	1	100	[1,00]	A
					2	881	[0,96]	
		100	881	22	3	22	[0,89]	
Reset) Query	1	2	3	4	54	[0,89]	
		[1,00]	[0,96]	[0,89]	5	466	[0,88]	
Gas	diesel	diesel	diesel	diesel	6	18	[0,88]	
Power	176	176	176	176	/	747	[0,88]	
Model	e_300_diesel	e_300_diesel	e_300_diesel	e_300_diesel	8	122	[0,88]	
Doors	4	4	5	5	9	512	[0,66]	
ZIP	3	3	5	2	11	876	[0,88]	
Color	yellow	yellow	yellow	green	12	617	[0,86]	
+ Extras	Navigation	Navigation	<<_ UNDEFINED _>>	Navigation	13	401	[0,85]	
^ Year	1996.0	1996.0	1995.0	1996.0	14	608	[0.85]	
Body	sedan	sedan	station_wagon	station_wagon	15	680	[0.85]	
Manufact] mercedes-benz	mercedes-benz	mercedes-benz	mercedes-benz	16	883	[0,84]	
CarCada	100	100	881	22	17	82	[0,84]	
Price	58499	58499	46499	44099	18	331	[0,84]	
Speed	224	224	224	224	19	143	[0,84]	
Miles	18146	18146	45604	51851	20	267	[0,84]	
Box amo	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	21	727	[0,84]	<u> </u>
Receiver	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	22	577	[0.84]	X
Bass	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	Start	4:36:03		
Box_Brand	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	Finish	4-36-05		
+ CDPlayer	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>		4.30.03		-11
					Duration:	2,096 sec	:	
						Show S	tatistics	
		H		1				

Car Classes Slots Forms Instances Similarity Modeling CBR Retrieval DETAILS AND QUERY Query 100 881 22 3 Reset Query 100 881 22 3 Cas diesel diesel diesel 6 18 0.961 Bows 176 176 76 176 6 18 2 3 Cas diesel diesel 300_diesel 300_diesel 6 18 0.881 Dows 4 300_diesel 300_diesel 6 18 0.881 ZIP 3 3 2 2 100 133 0.881 Vaar 1996.0 1995.0 1996.0 1996.0 1996.0 1996.0 Bady sedan sedan 181 22 15 6600 0.851 Price 54499 54499 6499 44099 12 617 0.881 Doctar Code <th>\varTheta 🖯 🔵 aut</th> <th>tos Protégé 3.1.1 (file:/Use</th> <th>rs/roth/Documents/workspac</th> <th>ce/mycbr/distribution/sar</th> <th>nples/auto_set/autos.pprj, Proté</th> <th>égé Files (.p</th> <th>ont and .p</th> <th>oins))</th> <th></th>	\varTheta 🖯 🔵 aut	tos Protégé 3.1.1 (file:/Use	rs/roth/Documents/workspac	ce/mycbr/distribution/sar	nples/auto_set/autos.pprj, Proté	égé Files (.p	ont and .p	oins))	
Classes Slots Forms Instances Similarity Modeling CBR Retrieval DETAILS AND QUERY Car Reset Query Query from Case Start Retrieval > Car Reset Query 100 881 22 3 22 0.0 Reset Query 1 2 3 22 0.0 3 22 0.0 Case Query 176) ~ D D X 20	4 4 4				<	🖉 pro	otégé
DETAILS AND QUERY Car Reset Query Query from Case Start Retrieval > r Case Name Sim Reset Query 100 881 22 3 100 1.00 2 881 0.2 881 0.06 3 2 0.891 3 2 0.891 3 2 0.891 5 4.66 1.06 1.06 1.06 1.06 1.06 1.06 3 2.2 0.891 5 4.66 1.081 6 1.8 0.8 6 1.8 0.8 6 1.8 0.8 6 1.8 0.8 6 1.8 0.8 6 1.8 0.8 6 1.8 0.8 1.0 5 4.66 0.881 6 1.8 0.8 1.0 5 4.66 0.881 1.2 0.1 0.8 1.2 0.1 0.8 1.2 0.1 0.8 1.2 6.1 0.8 1.2 6.1 0.8 1.2 0.2		• CI	asses 💻 Slots 🚍 Forms	s 🔶 Instances Simila	arity Modeling CBR Retrieval				
Car Reset Query Query from Case Start Retrieval r Case Name Sim Reset Query 100 881 22 3 22 0.891 Reset Query 1 2 3 22 0.891 Power 176 176 176 6 18 0.881 Doors 4 4 2 100 100 18 Doors 4 4 2 100 10.881 100 13.00.dissel Doors 4 4 2 100 10.881 100 513.00.881 Doors 4 4 2 100 513.00.881 100 513.00.881 Vellow yellow yellow green 11 876 0.881 Year 1996.0 1996.0 1996.0 13.401 10.851 Body sedan sedan tation_wagon station_wagon 16.683 16.831.0.641 Price	DETAILS	AND QUERY				QUERY R	ESULTS		
Car Reset Query Query from Case Start Retrieval > 1 100 1,096 Reset Query 1 2 3 22 0,891 Cas diesel diesel diesel 176 176 176 176 176 176 176 176 176 176 176 176 18 100 18.10 108 108 108 108 108 108 108 100 10.06 11.07 10.06 10.06 10.06 10.06 10.06 10.06 10.06 10.06 10.06 10.06 10.06 10.06 <th10.06< th=""> <th10.06< th=""> 10.06<td></td><td></td><td></td><td></td><td></td><td>r</td><td>Case Nam</td><td>e Sim</td><td></td></th10.06<></th10.06<>						r	Case Nam	e Sim	
Reset Query 100 881 22 3 22 881 (0,96) Cas diesel diesel issel diesel issel	Car	Reset Query	Query from Case	Start Retrie	eval) (<) (>)	1	100	[1,00]	
Reset Query 100 881 22 3 22 0,89 Gas diesel 1 2 3 4 54 (0,89) Gas diesel diesel diesel 16 16 8 10.89 Power 176 176 76 176 77 747 10.88 Doors 4 4 5 10.01 54 10.88 10.88 ZIP 3 3 2 10.88 10.88 9.929 10.88 Color yellow yellow ellow green 12 617 10.86 Body sedan sedan sedan sedan 13 401 10.85 Car Code 100 100 196.0 1996.0 13000 13 10.83 14 668 10.83 14 668 16.83 16 883 10.85 13 10.83 12 617 10.86 16			100	001	22	2	881	[0,96]	
Reset Query 1 2 3 4 54 (0,88) Gas diesel diesel liesel diesel diesel f.00,96) [0,89] 5 466 [0,88] Power 176 176 7 747 [0,88] Doors 4 4 4 9 929 [0,88] Doors 4 4 - 5 7 747 [0,88] Doors 4 4 - - 5 10 513 [0,88] Color yellow vellow green 11 576 [0,88] Color yellow yellow eellow green 11 617 [0,86] Maurigation Navigation sedan tation_wagon station_wagon 13 401 [0,85] Body sedan sedan tation_wagon station_wagon 14 688 [0,84] Price S8499 5499<	(a i	0	100	881	22	3	22	[0,89]	
Gas diesel diesel lesel diesel store 100	Reset	Query	1	2	3	4	54	[0,89]	
Gas diesel diesel diesel diesel 0 18 (0,85) Power 176 176 76 176 747 (0,88) Model e_300_diesel e_300_diesel e_300_diesel e_300_diesel 8 122 (0,88) Doors 4 4 2 10 513 (0,88) Color yellow yellow ellow green 11 876 (0,88) + Extras Navigation Navigation sedan station_wagon 12 617 (0,86) Body sedan sedan sedan station_wagon 13 401 (0,85) Maufact. mercedes-benz mercedes-benz mercedes-benz 15 680 (0,85) CCM 3000 3000 000 3000 16 883 10,84) Price 58499 5499 6499 44099 18 331 (0,84) Box_amo. < <undefined_>></undefined_>			[1,00]	[0,96]	[0,89]	5	400	[0,88]	
Power 176 176 76 176 76 176 776 176 776 176 776 176 776 176 776 176 776 176 776 176 776 176 776 176 <td>Gas</td> <td>diesel</td> <td>diesel</td> <td>liesel</td> <td>diesel</td> <td>7</td> <td>747</td> <td>[0,88]</td> <td></td>	Gas	diesel	diesel	liesel	diesel	7	747	[0,88]	
Model e.300_diesel e.300_diesel e.300_diesel e.300_diesel 9 929 (0,85) Doors 4 4 5 10 513 (0,88) ZIP 3 3 2 11 876 (0,88) Color yellow yellow green 11 876 (0,88) + Extras Navigation Navigation <	Power	176	176	.76	176	8	122	[0,88]	
Doors 4 4 5 10 513 10,88] ZIP 3 3 2 11 876 10,88] Color yellow yellow green 11 876 10,88] Year 1996.0 1996.0 995.0 1996.0 133 401 10,85] Body sedan sedan tation_wagon station_wagon 14 608 [0,85] CCM 3000 3000 000 3000 100 15 680 [0,84] Price 58499 58499 6499 44099 18 331 [0,84] Soed 224 224 224 224 224 19 143 [0,84] Soed 224 224 24 224 224 19 143 [0,84] Box_amo. <<	Model	e_300_diesel	e_300_diesel	_300_diesel	e_300_diesel	9	929	[0,88]	
ZIP 3 3 2 11 876 [0,88] Color yellow yellow green 11 876 [0,88] Year 1996.0 1996.0 995.0 1996.0 13 401 [0,85] Body sedan sedan tation_wagon station_wagon 14 608 [0,85] CCM 3000 3000 000 3000 15 680 [0,85] CCM 3000 3000 000 3000 16 883 [0,84] Price 58499 58499 6499 44099 18 331 [0,84] Speed 224 224 24 224 20 19 143 [0,84] Box_amo. <<	Doors	4	4	1	5	10	513	[0.88]	
CODY yeinow green 12 617 (0,86) + Extras Navigation <_UNDEFINED_>> Navigation 13 401 (0,85) Body sedan sedan tation_wagon station_wagon 14 608 (0,85) Manufact. mercedes-benz mercedes-benz mercedes-benz 15 680 (0,85) CCM 3000 3000 000 3000 100 16 883 (0,84) Price 58499 58499 6499 44099 18 331 (0,84) Speed 224 224 224 224 224 224 224 224 224 224 224 22 17 82 (0,84) Box_amo <<_UNDEFINED_>> <<_UNDEFINED_>> <<_UNDEFINED_>> <<_UNDEFINED_>> <	Color	3 Vollow	3 Vollow	nellow.	2	11	876	[0,88]	
Y Extras Navigatori		Navigation	Navigation		Navigation	12	617	[0,86]	
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Price 58499 58499 6499 44099 Speed 224 224 224 224 Miles 18146 18146 5604 51851 Box_amo <<_ UNDEFINED _>> <<<_ UNDEFINED _>> <<<_ UNDEFINED _>> Bass <<_ UNDEFINED _>> <<<_ UNDEFINED _>> <<<_ UNDEFINED _>> <	Car Code	e 100	100	81	22	17	82	[0,84]	
Speed 224 224 224 224 18146 18146 5604 51851 Box_amo. <<_ UNDEFINED _>> <<<_ UNDEFINED _>> <<	Price	58499	58499	<mark>.</mark> 6499	44099	18	331	[0,84]	
Miles 18146 18146 5604 51851 Box_amo. <	Speed	224	224	24	224	19	143	[0,84]	
Box_amo. <	Miles	18146	18146	+5604	51851	20	207	[0,84]	
Receiver <	Box_amo		<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	22	577	[0,84]	Ŧ
Bass <<_ UNDEFINED _>> <<<_ UNDEFINED _>> <<<_ UNDEFINED _>> <<<_ UNDEFINED _>> <<	Receiver_	< <<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<_ UNDEFINED _>>	<<_ UNDEFINED _>>		1.0.0.00	10.041	
Box_Branct << UNDEFINED _>> << UNDEFINED _>> << UNDEFINED _>> << UNDEFINED _>> Finish: 4:36:05 + CDPlayer << UNDEFINED _>> << UNDEFINED _>> << UNDEFINED _>> Finish: 4:36:05 Duration: 2,096 sec	Bass	<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<_ UNDEFINED _>>	<<_ UNDEFINED _>>	Star	t: 4:36:03		
+ICDPlayer <<_ UNDEPINED _>>	Box_Bran			<_ UNDEFINED _>>		Finish	1: 4:36:05		
	+ CDPlaye	ELI < <_ UNDEFINED _>>	<<_ UNDEFINED _>>	<_ UNDEFINED _>>	<<_ UNDEFINED _>>	Duration	1: 2,096 se	ec	
Show Statistics			<u>^</u>				Show	Statistic	s

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	44				\triangleleft	pro	tégé
C	Classes 💻 Slots 🚍 Forms	s 🔶 Instances Similari	ty Modeling CBR Retrieval				
DETAILS AND QUERY				QUERY R	SULTS		
				r	Case Name	Sim	-
Car Reset Query	Query from Case	Start Retrieva	al) $(\langle \rangle)$	1	100	[1,00]	
	100	001	22	2	881	[0,96]	
	100	881	22	3	22	[0,89]	
Reset Query	1	2	3	4	54	[0,89]	
	[1,00]	[0,96]	[0,89]	5	400	[0,00]	
Gas diesel	diesel	diesel	diesel	7	747	10,881	
Power 176	176	176	176	8	122	[0.88]	
Model e_300_diesei	e_300_diesei	e_300_diesei	e_300_diesei	9	929	[0.88]	
ZID 3	2	5	2	10	513	[0,88]	
	vellow	vellow	c green	11	876	[0,88]	
+ Extras Navigation	Navigation	<< UNDEFINED >>	Navigation	12	617	[0,86]	
^ Year 1996.0	1996.0	1995.0	1996.0	_ 13	401	[0,85]	
Body sedan	sedan	station_wagon	station_wagon	14	608	[0,85]	
Manufact mercedes-benz	mercedes-benz	mercedes-benz	mercedes-benz	15	680	[0,85]	
CCM 3000	3000	3000	3000	16	883	[0,84]	
Car Code 100	100	881	22	18	331	[0,64]	
Price 58499	58499	46499	44099	19	143	[0,84]	
Speed 224	224	224	224	20	267	[0.84]	
				21	727	[0,84]	
Box_amo <<_ UNDEFINED _>>				22	577	[0.84]	Ψ.
Rass << UNDEFINED >>	<< UNDEFINED >>	< UNDEFINED >>	<< UNDEFINED >>	Chart	4.36.03		
Box Brand <<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	Start	4.20.05		_
+ CDPlayer <<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	Finish	4:36:05		
				Duration	2,096 sec) 	
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	2	881	[0,96]
	3	22	[0, 89]
	4	54	[0,89]
	5	466	[0,88]
	6	18	[0,88]
	7	747	[0,88]
	8	122	[0,88]
	9	929	[0,88]
	10	513	[0,88]
	11	876	[0,88]
	12	617	[0,86]
	13	401	[0,85]
	14	608	[0,85]
	15	680	[0,85]
	16	883	[0,84]
	17	82	[0,84]
	18	331	[0,84]
	19	143	[0,84]
	20	267	[0,84]
	21	727	[0,84]
	22	577	[0.84]
	22	577	10.841
	51	727	[0,84]
	35555555		10 84



Reset	Query	1	2
		[1,00]	[0,96]
Gas	diesel	diesel	diesel
Power	176	176	176
Model	e_300_diesel	e_300_diesel	e_300_diesel
Doors	4	4	5
ZIP	3	3	5
Color	yellow	yellow	yellow
+ Extras	Navigation	Navigation	<<_ UNDEFINED _>>
Year	1996.0	1996.0	1995.0
Body	sedan	sedan	station_wagon
Manufact	mercedes-benz	mercedes-benz	mercedes-benz
CCM	3000	3000	3000
Car Code	100	100	881
Price	58499	58499	46499
Speed	224	224	224
Miles	18146	18146	45604
Box_amo	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>
Receiver	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>
Bass	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>
Box_Brand	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>
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+ CDPlayer <<_ UNDEFINED _>>

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[0,89] diesel 176 e_300_diesel 5 2 green Navigation 1996.0 station_wagon mercedes-benz 3000 22 44099 224 51851 <<_ UNDEFINED _>> <<_ UNDEFINED _>> <<_ UNDEFINED _>> <<_ UNDEFINED _>> <<_ UNDEFINED _>>

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3

Reset	Query	1 [1,00]		Backward ex
Gas	diesel	diesel	diesel	results via to
Power	176	176	176	Incal sim
Model	e_300_diesel	e_300_diesel	e_300	
Doors	4	4	5	 used am
ZIP	3	3	5	
Color	yellow	yellow	yellow	 Informat
+ Extras	Navigation	Navigation	<<_	(class hior
Year	1996.0	1996.0	1995	(01255111012
Body	sedan	sedan	statio	
Manufact	mercedes-benz	mercedes-benz	merce	aes-benz
CCM	3000	3000	3000	
Car Code	100	100	881	
Price	58499	58499	4649	9
Speed	224	224	224	
Miles	18146	18146	4560	4
Box_amo	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ l	JNDEFINED _>>
Receiver	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ l	JNDEFINED _>>
Bass	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ l	JNDEFINED _>>
Box_Brand	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ l	JNDEFINED _>>
+ CDPlayer	<<_ UNDEFINED _>>	<<_ UNDEFINED _>>	<<_ l	JNDEFINED _>>

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xplanations of retrieval oltips, for example: nilarity values nalgamation function tion on structural similarity archy)

mercedes-benz
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22
44099
224
51851
<<_ UNDEFINED _>>

<<_ UNDEFINED _>>

Explanation-based similarity measure modelling support

Floals

- Address questions of knowledge modeling from an explanation point of view
- Provide forward explanations for different slot types
- Give feedback on cases

Feedback from cases

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 autos Protégé 3.1.1 (fill autos Protégé 3.1.1 (fill CLASS BROWSER For Project: autos Class Hierarch SYSTEM-CLASS Car Soundsystem SLOT BROWSER For Project: autos Slot Hierarchy Year Doors Color Extras Model 	e:/Users/roth/Documents/worksp Classes Slots Forms SIMILARITY MEASURE FUNCTION Available functions CarFunc Attributes (Slots): Attributes (Slots): CarFunc Attribute Body 100% CCM 100% CCM 100% Car Code 100% Color 100% Color 100% Gas 100% Gas 100% Manufacturer 100% Miles 100% Manufacturer 100% Miles 100% Model 100% Power 100% Speed 100% Spee	Ace/mycbr/distribution/samples/auto	e CBR Retrieval
 Miles Power Speed Body Sound Car Code CCM Manufacturer ZIP Gas 	Cannot inherit!		 Weighted Sum Euclidean Ma



Feedback from cases

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	CarFunc	New Duplicate	
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► O :SYSTEM-CLASS	Association of Classics		
Car	Attributes (Slots):	dia animina at	
Soundsystem	Rody 1(discriminant igh	t comment
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	Car Code 10	00%	0
88	Color 10	00%	1
SLOT BROWSER	Doors 10	00%	1
For Project: • autos	Gas 10	00%	1
	Manufacturer 10	00%	1
Slot Hierarchy	Miles 10		1
Doors	Power 10		1
= Color	Price 10	00%	1
Extras	Speed 10	00%	1
Model	Year 10	00%	1
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Sound			
Car Code			
Manufacturer			
= ZIP			
Gas T	annot inherit!		💽 Weighted Sum 🔘 Minimum
- 88			🔘 Euclidean 🛛 🔿 Maximum
	L		

How many cases have values for the given slot?

Feedback from cases

\varTheta 🔿 🔿 autos Protégé 3.1.1 (file	:/Users/roth/Documents/workspace/mycbr/distribution/samples/auto_set/autos.pprj, Protégé Files (.pont and .pins)))
	🖻 🖆 🤎 🖤	ġé
	Classes Slots Forms Instances Similarity Modeling CBR Retrieval	
CLASS BROWSER	SIMILARITY MEASURE FUNCTIONS	
For Project: 🕈 autos	Available functions	
Class Hierarch & X + X -	CarFunc New Duplicate	
0 :THING	Delete Active	
► O :SYSTEM-CLASS	Attributes (Slots):	
Car	attribute discriminant	-11
Soundsystem	Body 100% I	-
	CCM 100% 1	
	Car Code 100% 1	
88	Color 100% 🗹 1	
SLOT BROWSER	Doors 100% 🗹 1	
For Project: 🕈 autos	Gas 100% 1	
	Manufacturer 100% 1	
Slot Hierarchy	Miles 100% 1	
Doors		
= Color	Price 100%	
Extras	Speed 100%	
Model Nodel	Year 100% 1	
Miles	ZIP 100%	
Power Speed	Extras 154%	
= Body	Sound 0%	
Sound		
Car Code		
= CCM		
Manufacturer		
Gas	🖂 cannot inherit! 💽 Weighted Sum 🔘 Minimum	1
		_
	C Edendeari C Maximun	
		- 1

given slot? No use in spending time on a similarity function for slot "Sound"!

How many

cases have

values for the

Distribution of values

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\varTheta \varTheta 🔵 autos Protégé 3.1.1 (file:/	Users/roth/Documents/worksp	ace/mycbr/distri	bution/samples/a	uto_set/autos.pp	rj, Protégé Files	(.pont and .pins))
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	SIMILARITY MEASURE FUNCT	TIONS				
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roi rioject. • autos	BodyEuro		New Dur	licata		
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	Symmetry: 🔍 symmetric	asymmetric				
			Case Base Valu	ies		
	Reset convertible	coupe	fastback	roadster	sedan	station_wagon
SLOT BROWSER	coupe 5% 0.0	1.0	0.2	0.0	0.7	0.5
For Project: 🖶 autos	fast 12% 0.2	0.2	1.0	0.5	0.0	0.0
	road 4% 0.7	0.0	0.5	1.0	0.0	0.0
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Year	Stating 200					
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How often is the respective symbol used in the case base?

Distribution of values

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es Slots Forms 🔶 I	nstances 🦳 🧶 Similarity Measure Edit	or 🛛 🔴 CBR Retrieval
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	Case Base Values	
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How often is the respective symbol used in the case base?

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	DS ? Query value: 3500	
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Distribution of case values



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Distribution of case values

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	-5000 -2500 0 2500 5000	
		1000 2250


Status and plans

Daniel Bahls (graduate student) programmed most of myCBR.

works on a first prototype for basic similarity measure modeling support (project thesis)

presented a student poster on myCBR and explanations at AAAI-07 in Vancouver, Canada

Follow-up diploma thesis: Design and development of a generic (forward) explanation component.

Generating model from CSV file

0	O Cars_casebase.csv								
\diamond	A	В	С	D	E	F	G	Н	
1	Car Code	Manufacturer	Model	Body	Price	Color	Year	Miles	Doors
2	2	bmw	325td	sedan	28699	dark_red	1995	66474	
3	3	bmw	320i	coupe	33299	dark_red	1995	31802	
4	4	bmw	540i	station_wago	87499	dark_green	1997	9874	
5	5	bmw	520i	station_wago	43599	black	1996	32292	
6	6	bmw	316i	fastback	25599	dark_red	1995	53714	
7	7	bmw	523i	station_wago	55599	gray	1997	11230	
8	8	bmw	318i	coupe	39099	light_gray	1996	12428	
9	9	bmw	318i	sedan	30399	dark_gray	1995	43979	
10	10	bmw	318i	sedan	16499	light_gray	1995	120039	
11	11	mercedes-be	e_280	station_wago	58699	yellow	1997	17742	
12	12	audi	a4_1.9_tdi	station_wago	31899	dark_green	1994	36304	
13	13	bmw	525tds	station_wago	34899	white	1995	65071	
14	14	mercedes-be	c_200	station_wago	14599	violet	1995	148011	
15	15	mercedes-be	e_430	sedan	41499	blue	1994	105427	
16	16	bmw	325tds	sedan	41899	turquoise	1996	25976	

 Columns become attributes
Based on column content myCBR choses attribute type
Explanations required!

Generating model from CSV file

0	O O ☐ cars_casebase.csv								
\diamond	Α	В	С	D	E	F	G	Н	
1	Car Code	Manufacturer	Model	Body	Price	Color	Year	Miles	Doors
2	2	bmw	325td	sedan	28699	dark_red	1995	66474	
3	3	bmw	3201	coupe	33299	dark_red	1995	31802	
4	4	bmw	540i	station_wago	87499	dark_green	1997	9874	
5	5	bmw	520i	station_wago	43599	black	1996	32292	
6	6	bmw	316i	fastback	25599	dark_red	1995	53714	
7	7	bmw	523i	station_wago	55599	gray	1997	11230	
8	8	bmw	318i	coupe	39099	light_gray	1996	12428	
9	9	bmw	318i	sedan	30399	dark_gray	1995	43979	
10	10	bmw	318i	sedan	16499	light_gray	1995	120039	
11	11	mercedes-be	e_280	station_wago	58699	yellow	1997	17742	
12	12	audi	a4_1.9_tdi	station_wago	31899	dark_green	1994	36304	
13	13	bmw	525tds	station_wage	34899	white	1995	65071	
14	14	mercedes-be	c_200	station_wago	14599	violet	1995	148011	
15	15	mercedes-be	e_430	sedan	41499	blue	1994	105427	
16	16	bmw	325tds	sedan	41899	turquoise	1996	25976	

 Columns become attributes
Based on column content myCBR choses attribute type

Explanations required!

Generating model from CSV file

Columns become attributes Based on column content myCBR choses attribute type

Explanations required!

0	O O Cars_casebase.csv									
\diamond	A	В	С	D	E	F	G	Н		
1	Car Code	Manufacturer	Model	Body	Price	Color	Year	Miles	Doors	
2	2	bmw	325td	sedan	28699	dark_red	1995	66474		
3	3	bmw	3201	coupe	33299	dark_red	1995	31802		
4	4	bmw	540i	station_wago	87499	dark_green	1997	9874		
5	5	bmw	5201	station_wago	43599	black	1996	32292		
6	6	bmw	316	fastback	25599	dark_red	1995	53714		
	/	bmw	21.01	station_wago	20000	gray light gray	1997	11230		
0	0	bmw	318	coupe	30300	dark gray	1990	12420		
10	10	bmw	318	sedan	16499	light gray	1995	120039		
11	11	mercedes-be	e 280	station wago	58699	vellow	1993	17742		
12	12	audi	a4 1.9 tdi	station_wago	31899	dark green	1994	36304		
13	13	bmw	525tds	station wage	34899	white	1995	65071		
14	14	mercedes-be	c 200	station wago	14599	violet	1995	148011		
15	15	mercedes-be	e_430	sedan	41499	blue	1994	105427		
16	16	bmw	325tds	sedan	41899	turquoise	1996	25976		
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5 I -	Body	single	Symbol		allowed-valu	es={convertil	ble,coupe,fastl	oack,roadster	,sedan	
8.	Car Code	single	Integer		minimum=0	maximum=	10000000			
		single	Integer		minimum 1		- 6000			
5	CCM	single	Integer		minimum=1	000, maximu	m=6000			
8 P	Color	single	Symbol		allowed-valu	es={anthraci	te,black,blue,d	lark_blue,darl	k_gray,	
	Doors	single	Integer		minimum=2, maximum=7					
	Extras	multiple	Symbol		allowed-values={ABS,ESP,Navigation}					
	Gas	single	Symbol		allowed-valu	es={diesel,ga	asoline}			
	Manufacture	r single	Symbol		allowed-valu	es={audi,bm	w,mercedes-b	enz,vw}		
	Miles	single	Integer		minimum=0	maximum=	1000000			
	Model	single	Symbol		allowed-valu	es={316i.31	81,3201,3231,3	25td.325tds.	3281.5	
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	Speed	single	Integer		minimum=100, maximum=300					
	Year	single	Float		minimum=1950.0, maximum=2007.0					
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1	Car Code	Manufacturer	Model	Body	Price	Color	Year	Miles	Doors		
2	2	bmw	325td	sedan	28699	dark_red	1995	66474			
3	3	bmw	3201	coupe	33299	dark_red	1995	31802			
4 5	4	bmw	5201	station_wago	43500	black	1997	32202			
6	6	bmw	316	fastback	25599	dark red	1995	53714			
7	7	bmw	523	station wago	55599	grav	1997	11230			
8	8	bmw	318i	coupe	39099	light_gray	1996	12428			
9	9	bmw	318i	sedan	30399	dark_gray	1995	43979			
10	10	bmw	318i	sedan	16499	light_gray	1995	120039			
11	11	mercedes-be	e_280	station_wago	58699	yellow	1997	17742			
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	Car Code	single	Integer		minimum=0	, maximum=1	10000000				
12	CCM	single	Integer		minimum=1	000, maximu	m=6000				
	Color	single	Symbol		allowed-values={anthracite,black,blue,dark_blue,dark_gray,						
	Doors	single	Integer		minimum=2, maximum=7						
	Extras	multiple	Symbol		allowed-values={ABS,ESP.Navigation}						
	Gas	single	Symbol		allowed-values={diesel.gasoline}						
	Manufacture	single	Symbol		allowed-values={audi,bmw.mercedes-benz.vw}						
	Miles	single	Integer		minimum=0	. maximum=1	000000	,			
	Model	single	Symbol		allowed-valu	es={316i.31	8i.320i.323i.3	25td.325tds.	328i.5		
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Kinds of explanations

- The goal of conceptual explanations is to build links between unknown and known concepts.
- Variations:
 - **Definition:** "What is a bicycle?" "A bicycle is a land vehicle with two wheels in line. Pedal cycles are powered by a seated human rider and are a form of human powered vehicle."
 - **Theoretical proposition:** "What is force?" "Force is Mass times Acceleration." Prototypical usage of individual things or actions: "What is a bicycle?" -"The thing, this man crashed with." **Functional mapping:** "What is a bicycle?" – "A bicycle serves as a means of transport."

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How-explanations

The goal of how-explanations is to help the questioner understand the functionality of an object.

Example:

"How does a combustion engine work?" – "A combustion engine is an engine that operates by burning its fuel."



Cognitive explanations

 Cognitive explanations explain the activities of the system.

Examples:

Action explanations: "Why was this seat post selected?" – "For the given price, only one other seat post was available. But this was too short." Negative explanations: "Why was no carrier chosen?" – "A carrier is only available for touring bikes. The user did not choose a touring bike."



Explanation goals

Sørmo, F., Cassens, J., Aamodt, A.: Explanation in Case-Based Reasoning - Perspectives and Goals, 2005.

Explanation goals

- Transparency
- Justification
- Relevance
- Conceptualization
- Learning



Sørmo, F., Cassens, J., Aamodt, A.: Explanation in Case-Based Reasoning - Perspectives and Goals, 2005.

Explanation architecture

An explanation-enabled architecture needs to consider the ...

Explanation scenario

- Problem and problem solver in question
- User and user model
- Background knowledge for explanation













Summary

- Basic explanation scenario: user (interface), originator, and explainer
- Explanations are a special kind of information with cognitive and computational aspects.
- Examples:

Backward explanations in Nepomuk

Forward explanations in myCBR

Outlook / Goal: Explanation-enabled architecture

On Explanation —Supporting the Use of Complex Information Systems—

Thank you!

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