Case Base Reasoning Tool Suite

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What is Case Based Reasoning?

- CBR is a machine learning methodology
- **Process** of solving new problems based on solutions of similar past problems
- CBR is founded upon the observation that humans are much more capable of recalling experiences than of articulating internal rules
General Overview

1. Input
2. Test Case Generator
3. Reasoner
4. RobotSTAF
5. Analyzer
6. Database

Results sent to RobotSTAF for outcome comparison.
Meet the Test Team
Meet CBR

I have *smartly* automated the process of test case generation, selection, execution, and result analysis!
CBR to the Rescue
Test Case Selection
Meet RobotSTAF

RobotSTAF Executing Tests
More Deadlines!

Documentation and Analysis Due TOMORROW!!

I wonder if CBR could help?
Detective CBR to the Rescue

Documentation and Analysis
Due TOMORROW!!

NO PROBLEM!
- CBR

NLP Commencing
We Finished!

Pass and Fail Results

Test Case Documentation
Kibana Dashboard
## Test Case Generation and Selection Metrics

<table>
<thead>
<tr>
<th>Run #</th>
<th>Commands in Case Library</th>
<th>Commands Reasoned</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>50</td>
<td>.2267 sec</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>50</td>
<td>.3359 sec</td>
</tr>
<tr>
<td>3</td>
<td>49</td>
<td>50</td>
<td>.3620 sec</td>
</tr>
<tr>
<td>4</td>
<td>84</td>
<td>50</td>
<td>.4574 sec</td>
</tr>
</tbody>
</table>

'CBR-20171001-182256-580856-nogui'
```
chill_down --noGUI --venueType ATLO --testbedName ATLOC --inputFormat RAW_TF --sessionDssId '10' --downlinkConnectionType CLIENT_SOCKET
chill_monitor --venueType 'ATLO' --types 'BacklogSummary' --testbedName 'ATLOC' --sessionDssId '10'
chill_get_chanvals --orderBy 'Station' --outputFormat 'sr_csv' --channelTypes 'm' --channelIds 'MHLI-%,ACS-%,HGA-%,RSB-%',
chill_get_sessions --orderBy 'SseVersion' --outputFormat 'xml',
chill_get_packets --orderBy 'SCET' --outputFormat 'onelinesummary' --packetApid '257..556' --timeType 'LST',
chill_get_commands --orderBy 'EventTime' --outputFormat 'sr_csv' --timeType 'RCT' --commandStringPattern 'MRDI_NO_OP'
```
Benefits of the CBR Tool Suite

• **Adaptable:** Can be reused to test many different systems

• **Range:** Increases accuracy of testing and results in greater test coverage.

• **Regression Testing:** Test results can be reproduced to ensure software stability.

• **Fewer Resources:** Less time spent on running tests and less resources used to conduct the tests.
The End

Any Questions?
Backup
What is Artificial Intelligence?

Artificial Intelligence (AI): General Term
Relies on rules provided by domain experts to solve problems, such as medical diagnoses, by asking a series of questions.

Machine Learning: Beyond AI
The computer extracts knowledge through supervised experience.

Typically involves a human operator helping the machine learn by giving it hundreds or thousands of training examples, and correcting its mistakes.

Deep Learning: Machine Learning Technique
Deep learning is unsupervised. It involves creating large-scale neural nets that allow the computer to learn and “think” by itself without the need for direct human intervention.
Priority Based Algorithm

Algorithm

• Calculates an average impact value for each flag set

• Each flag in the AMPCS subsystem is assigned a weight value ranging from 1-5

• Algorithm is used to eliminate flag sets that do not contain significant values

• Threshold value is configured by the user

<table>
<thead>
<tr>
<th>Flag</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>fswDictionaryDir</td>
<td>5</td>
</tr>
<tr>
<td>spacecraftID</td>
<td>3.5</td>
</tr>
<tr>
<td>sseDictionaryDir</td>
<td>5</td>
</tr>
<tr>
<td>sseDownlinkPort</td>
<td>2</td>
</tr>
<tr>
<td>testHostPattern</td>
<td>1</td>
</tr>
<tr>
<td>vcid</td>
<td>3</td>
</tr>
<tr>
<td>venueType</td>
<td>4</td>
</tr>
</tbody>
</table>
Analyzer

Parses files to **identify key words or phrases** that led to the final pass or fail outcome.

**Naïve Bayes Algorithm**
- A Naive Bayes Classifier predicts a class value for a given a set of attributes.
- Use Bayes rule to derive conditional probabilities for the class variable

**Classification**
- Task of choosing the correct class label for a given input.

**Negative Class**
- Java, AMPCS, and MySQL Error Messages
- Negative Statements
- Generic Negative Words

**Positive Class**
- Java, MySQL, and AMPCS Success Messages
- Positive Statements
- Generic Positive Words