CASRE

Computer Aided Software Reliability Estimation
Agenda

- Introduction to CASRE
- How to use CASRE
- Demo
What’s CASRE?

- **Computer Aided Software Reliability Estimation**
- Software reliability measurement tool, easy to use.
- CASRE incorporates the mathematical modelling capabilities of the Statistical Modelling and Estimation of Reliability Functions for Software (SMERFS).
CASRE Features

- Allow users to determine whether a set of failure data indicates that the system's reliability is increasing during test, whether it is decreasing, or whether there is no discernable trend.

- Two trend tests that may be used to determine whether it is even appropriate to apply a software reliability model to a set of failure data.
These two tests are
- The running arithmetic average
- The Laplace test,

Allow users to determine whether a set of failure data indicates that the system's reliability is increasing during test or not

For more info check:
### CASRE GUI

**Test Number** | **Number of Failures** | **Hours in a Test Interval** | **Severity**
---|---|---|---
1 | 9.000000e+000 | 5.600000e+001 | 1
1 | 3.000000e+000 | 5.600000e+001 | 2
1 | 2.000000e+000 | 5.600000e+001 | 3
2 | 1.900000e+001 | 5.600000e+001 | 1
3 | 1.000000e+001 | 5.600000e+001 | 1
3 | 2.000000e+000 | 5.600000e+001 | 2
3 | 2.000000e+000 | 5.600000e+001 | 3
3 | 1.000000e+001 | 5.600000e+001 | 4
4 | 1.200000e+001 | 5.600000e+001 | 1
5 | 2.200000e+001 | 5.600000e+001 | 1
5 | 1.200000e+001 | 5.600000e+001 | 1
6 | 1.000000e+001 | 5.600000e+001 | 1
6 | 1.000000e+001 | 5.600000e+001 | 2
7 | 2.000000e+000 | 5.600000e+001 | 3
8 | 1.900000e+001 | 5.600000e+001 | 1
9 | 1.000000e+001 | 5.600000e+001 | 1
10 | 5.000000e+000 | 5.600000e+001 | 1
11 | 5.000000e+000 | 5.600000e+001 | 1
12 | 5.000000e+000 | 5.600000e+001 | 1
13 | 7.000000e+000 | 5.600000e+001 | 1
14 | 7.000000e+000 | 5.600000e+001 | 1
15 | 1.000000e+001 | 5.600000e+001 | 1
16 | 2.000000e+000 | 5.600000e+001 | 1
17 | 1.000000e+001 | 5.600000e+001 | 2
17 | 1.000000e+001 | 5.600000e+001 | 1
18 | 1.000000e+001 | 5.600000e+001 | 2
19 | 2.000000e+000 | 5.600000e+001 | 1
19 | 1.000000e+001 | 5.600000e+001 | 1
19 | 1.000000e+001 | 5.600000e+001 | 2
19 | 1.000000e+001 | 5.600000e+001 | 4
20 | 2.000000e+000 | 5.600000e+001 | 1
21 | 9.000000e+000 | 5.600000e+001 | 1
22 | 1.000000e+001 | 5.600000e+001 | 1
23 | 0.000000e+000 | 5.600000e+001 | N/A
24 | 0.000000e+000 | 5.600000e+001 | N/A
25 | 1.000000e+001 | 5.600000e+001 | 1
25 | 1.000000e+001 | 5.600000e+001 | 1
25 | 1.000000e+001 | 5.600000e+001 | 2
25 | 1.000000e+001 | 5.600000e+001 | 3
26 | 1.000000e+001 | 5.600000e+001 | 1
27 | 1.000000e+001 | 5.600000e+001 | 1
GUI Features

The interface is menu driven; enabling and disabling of menu options guides users through:

- selection of a set of failure data
- execution of a model, and
- analysis of
- model results through various plots
How to Use CASRE

- The idea behind CASRE is to:
  - select a set of failure data,
  - choose how far into the future you want to predict reliability,
  - select and run models,
  - look at model results,
  - and determine which model is most appropriate to the data.
Using CASRE

The Main Steps to Use CASRE are:

1. Create a set of failure data.
2. Start CASRE.
3. Open a set of failure data.
4. Change the failure data.
5. Apply filters and smoothing operations to the data.
6. Apply trend tests to the failure data to determine whether or not software reliability models should be applied.
7. Apply models to the failure data.
8. View the model outputs.
9. Print failure data and model results.
10. Save failure data and model results to disk.
Step 1: Create a set of failure data
- Failure data files must be in specific format.
- One way to create these files is to use a word processor or text editor.

There are two kinds of failure data:
- Time between failures.
- Failure count.

Each kind has specific format.
Create Failure Data

- Time between failures (File Format):
  - The first line represents the time units for the data file. You have a choice of seven keywords
    - Seconds
    - Minutes
    - Hours
    - Days
    - Weeks
    - Months
    - Years
The following points apply to the second and subsequent lines of the data file:

- The first column is the current failure number.
- The second column represents the time that has passed since the last failure was observed.
- The values in the second column are measured in the time units given in the first line of the file.
- The third column indicates the severity of the failure on a scale of 1 to 9.
Failures Count

- Failures Count (File Format):
  - The first line represents the time units for the data file.

- The following points apply to the second and subsequent lines of the data file:
  - The first column gives a sequential test interval number.
  - The second column specifies the number of failures that were observed during a given test interval.
  - The third column gives the length of the test interval. Test interval lengths do not have to be equal.
  - The fourth column indicates the severity of the failure on a scale of 1 to 9.
Step 1 – Example for Input Data

- Two types of inputs:
  - Time between failures
    - seconds
    - 1 10 2
    - 2 5 7
    - 3 60 3
  - Failure count
    - minutes
    - 1 5 20 4
    - 2 9 30 2
    - 3 2 40 8
Step 2, 3, and 4

- **Step 2: Start CASRE**
  - You can install CASRE on your machine or run the CASRE executable file.
  - Here we use the second option and we start CASRE by running CASRE.exe file.
  - Once the CASRE window is on your screen, start CASRE by using the mouse to double click on the CASRE icon within that window.
  - The CASRE main window should then appear as shown.
CASRE Main Window
Loading Failure Data

- Step 3: Opening a Data File
  - Go to File -> Open
  - Browse to the directory where the file is located and select it to open it.
  - When a failure data file is opened, the text of the file is shown in the main window, while a plot of the data is shown in the graphic display window.
Open Time Between Failure File

- For instance, the figure below shows the data file corresponding to the file "tbe_tst2.dat" in the data subdirectory.
Open Failures Count File

- An example of data file containing failure counts is file “fc_test.data” in the directory

```
<table>
<thead>
<tr>
<th>Test Interval</th>
<th>Number of Failures</th>
<th>Hours in a Test Interval</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.000000e+00</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>1.900000e+00</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>2.300000e+00</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1.200000e+01</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
<tr>
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<td>5.600000e+00</td>
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</tr>
<tr>
<td>6</td>
<td>1.200000e+01</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
<tr>
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<td>1.300000e+01</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
<tr>
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<td>1.500000e+01</td>
<td>5.600000e+00</td>
<td>1</td>
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<td>1</td>
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<td>16</td>
<td>3.000000e+00</td>
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<td>1</td>
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<td>1</td>
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<td>5.600000e+00</td>
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<td>N/A</td>
</tr>
<tr>
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<td>1.000000e+00</td>
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<tr>
<td>27</td>
<td>1.000000e+00</td>
<td>5.600000e+00</td>
<td>1</td>
</tr>
</tbody>
</table>
```
Edit Failure Data

- Step 4: Change the failure data
  - Covert between data types.
  - Use external application to edit the data file.
Covert between data types

- As an example, convert the data set tbe_tst2.dat from time between failures to failure counts, using a test interval length of 100,800 seconds.
Steps 5, 6, 7, and 8

- **Step 5: Filters and smoothing operations**
  - Shaping and scaling filters for changing the shape of the failure data curve.
  - A filter for changing the time units for a failure data set. For instance, if a time between failures data set records time between failures in seconds, you can apply this filter to change the times between failures to minutes.
  - A Hann window for removing noise from the failure data.
  - The capability of selecting a subset of the failure data based on severity classification.
  - A filter for rounding the failure data to the nearest whole number.
CASRE Data Filter Options
Identifying Trends

- Step 6: Apply trend tests.
  - Determine whether a set of failure data exhibits reliability growth
  - Running Arithmetic Average of Time Between Failures/Failure Counts
  - Laplace Test
The results of applying the running arithmetic average to the last plot (failure count). The graph indicates that the failures are decreasing over time.
Running Arithmetic Average 2

- Applying the running arithmetic average to the data file tbe_tst2.dat (time between failures). The graph indicates that the failures are increasing over time.
Reliability Models

- Step 7, 8: Apply Reliability Model and View Results
  - Let us look at model results and model evaluation statistics for the following scenario.
    - Failure data: Same as that used before. That is, the file tbe_tst2.dat (time between failures data).
    - Data Range: We've selected points 100-194 as the interval to which to apply the data.
    - The Parameter Estimation End Point is 150.
    - No of future failures is 20.
    - Models selected: We'll be looking at the results of the Musa Basic, Musa-Okumoto, Linear-LV, and Quadratic-LV models.
Reliability Models Configuration

- Go to the Model menu in CASRE as shown in the next figure.
Set the Data Range

- Go to: Model → Select Data Range
(See the Next Figure)
Set Future Predictions

- Go to:
  Model → Prediction
  (See the Next Figure)
Select Reliability Models

- Go to: Model → Select and run Models...
  Then a new dialog will show up (See the Next Figure)
Display Results

- From the Graph Window select "Select model results"
Results