Overview

Motivation

- Wide range of diagnostic algorithms have been developed for aerospace systems to enable autonomous health management
- Lack of comparative analyses for different diagnostic algorithms creates barriers for effective development and deployment
- Difficult to assess the pros and cons of different diagnostic approaches

Benefits

- Generates realistic and standardized datasets to be used for empirical evaluation of monitoring and diagnosis systems
- Provides common vocabularies and ontologies, and well-defined metrics that enable comparative analysis of different diagnostic algorithms and systems
- Encourages the development of software platforms that promise more rapid, accessible, and effective maturation of diagnostic technologies

Objectives

- Develop a formal framework to be used for systematic benchmarking of monitoring and diagnostic systems
- Produce comparable performance assessment results for different monitoring and diagnostic technologies
- Provide an empirical approach that can be utilized by algorithm developers to test and validate their technologies

Methodology

ADAPT

- The framework defines a number of specifications for comparison:
  - Standardized Fault Catalog
  - Metric Definitions
  - Standardized API Architecture
  - Experimental Protocol
  - Metric Calculation Software

Experimental Protocol

- The benchmarking analysis is performed by means of empirical testing using the Advanced Diagnostics and Prognostics Testbed (ADAPT).
  - The facility’s hardware consists of an electrical power system with components for power generation, storage, and distribution.
  - Over a hundred sensors report the status of the system. The test bed provides a controlled environment to inject failures, either through software or hardware, in a repeatable manner.

Metrics

- The framework defines a number of specifications for comparison:
  - Standardized Fault Catalog
  - Metric Definitions
  - Standardized API Architecture
  - Experimental Protocol
  - Metric Calculation Software

Results

- Developed the framework architecture
- Defined the fault catalog, the metrics, the API architecture, and the experimental protocol
- Developed benchmarking software on MATLAB
- Generated preliminary results

- Diagnostic Competition (DXC-09, June)
  - [http://www.dx-competition.org/](http://www.dx-competition.org/)
  - Industrial Track Using ADAPT
  - Synthetic Track Using ISCAS-85

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**Status**

**Diagnostic Competition**

<table>
<thead>
<tr>
<th>METRIC RESULTS</th>
<th>ALGORITHM A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Fault Detection Time (sec)</td>
<td>8.977</td>
</tr>
<tr>
<td>Detection False Positive Rate</td>
<td>0.000</td>
</tr>
<tr>
<td>Detection False Negative Rate</td>
<td>0.000</td>
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<tr>
<td>Fault Detection Accuracy</td>
<td>1.000</td>
</tr>
<tr>
<td>Isolation Classification Rate</td>
<td>0.972</td>
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