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IEEE Guide for the Use of Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE)

IEEE Standards Coordinating Committee 20

Sponsored by the
IEEE Standards Coordinating Committee 20 on
Test and Diagnosis for Electronic Systems

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Abstract: Guidance to developers of IEEE Std 1232-conformant applications is provided in this guide. A simple doorbell is used as an example system under test to illustrate how the static model constructs of Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE) are used to form a diagnostic reasoner knowledge base. Each of AI-ESTATE's knowledge base types is discussed in conceptual terms, and how those concepts are represented in exchange files is shown. Also, some of the nuanced aspects of diagnostic knowledge bases in AI-ESTATE are clarified. An example reasoner session is provided to illustrate the use of AI-ESTATE services.

Keywords: AI-ESTATE, Bayesian Network, diagnosis, diagnostic inference, diagnostic model, diagnostic services, D-matrix, fault tree, IEEE 1232.3™, knowledge exchange, reasoner, system test

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Introduction

This introduction is not part of IEEE Std 1232.3™-2014, IEEE Guide for the Use of Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE).

IEEE Std 1232™-2010, IEEE Standard for Artificial Intelligence Exchange and Service Tie to All Test Environments (AI-ESTATE) defines formal information models and software services specific to several different types of diagnostic reasoners to enable unambiguous access to and understanding of the information supporting system test and diagnosis. This guide supplements IEEE Std 1232-2010 and is part of the document set.

This guide has been prepared to help all users of IEEE Std 1232-2010. IEEE Std 1232-2010 may be used within any test discipline and with any carrier language, and the examples provided in this guide should be seen as typical.

This guide explains AI-ESTATE features and application using a consistent simple doorbell system example. It describes the static diagnostic model information contained in the Common Element Model (CEM) and four additional specialized diagnostic model types. The guide also shows how the standard supports the dynamic operation of the reasoner using standard services.

The need for a guide arose from the experience of users in the creation of diagnostic models and applications using IEEE Std 1232-2010. This experience showed that further information and examples on the implementation and application of the standard was required. The purpose of this guide is to provide guidance in the technique of implementation, application, and usage of the basic diagnostic models defined in IEEE Std 1232-2010 to create diagnostic models and reasoning applications. This is seen as particularly important in promoting the use of a relatively new and unambiguous method of describing diagnostic information. This guide is not intended to be used as an instruction manual for IEEE Std 1232-2010 nor as a substitute for formal training, but by its nature it should find some application in the training environment.

Clause 5 is intended as a brief introduction to the history and development of AI-ESTATE. Clause 7 concentrates on the description of the static diagnostic models used to describe system test and diagnosis information. The Common Element Model (CEM), Fault Tree Model (FTM), Bayesian Network Model (BNM), Dmatrix Inference Model (DIM), and Diagnostic Logic Model (DLM) are all covered. Clause 8 provides a description of the AI-ESTATE reasoner services and provides a diagnostic session sequence example.

IEEE Std 1232-2010 does not specify any particular software language, interface bindings, or client-reasoner communication framework, and this guide does not provide any advice on this topic.

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1. Overview

1.1 Scope

IEEE Std 1232.3™-2014 provides guidance to developers of IEEE Std 1232-conformant diagnostic applications that utilize the models, services, or exchange formats specified by IEEE Std 1232.

1.2 Purpose

IEEE Std 1232 addresses the complex domain of system test and diagnosis and specifies formal semantic models for information exchange and services to be provided by diagnostic reasoners in this domain. The formality of the semantic models necessitates an in-depth understanding of the associated concepts to ensure that interoperability and interchangeability requirements can be satisfied. IEEE Std 1232.3 provides this understanding by describing the history, motivation, and key concepts from AI-ESTATE to help developers extract maximum benefit from IEEE Std 1232. In addition, examples of instantiated models, exchange files, and service scenarios are provided.