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Artificial Intelligence (AI) — Assessment of the robustness of neural networks —

Part 1:
Overview



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Foreword

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html. In the IEC, see www.iec.ch/understanding-standards.

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A list of all parts in the ISO/IEC 24029 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

When designing an AI system, several properties are often considered desirable, such as robustness, resiliency, reliability, accuracy, safety, security, privacy. A definition of robustness is provided in 3.6. Robustness is a crucial property that poses new challenges in the context of AI systems. For example, in AI systems there are some risks specifically tied to the robustness of AI systems. Understanding these risks is essential for the adoption of AI in many contexts. This document aims at providing an overview of the approaches available to assess these risks, with a particular focus on neural networks, which are heavily used in industry, government and academia.

In many organizations, software validation is an essential part of putting software into production. The objective is to ensure various properties including safety and performance of the software used in all parts of the system. In some domains, the software validation and verification process is also an important part of system certification. For example, in the automotive or aeronautic fields, existing standards, such as ISO 26262 or Reference [2], require some specific actions to justify the design, the implementation and the testing of any piece of embedded software.

The techniques used in AI systems are also subject to validation. However, common techniques used in AI systems pose new challenges that require specific approaches in order to ensure adequate testing and validation.

AI technologies are designed to fulfil various tasks, including interpolation/regression, classification and other tasks.

While many methods exist for validating non-AI systems, they are not always directly applicable to AI systems, and neural networks in particular. Neural network systems represent a specific challenge as they are both hard to explain and sometimes have unexpected behaviour due to their non-linear nature. As a result, alternative approaches are needed.

Methods are categorized into three groups: statistical methods, formal methods and empirical methods. This document provides background on these methods to assess the robustness of neural networks.

It is noted that characterizing the robustness of neural networks is an open area of research, and there are limitations to both testing and validation approaches.

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Artificial Intelligence (AI) — Assessment of the robustness of neural networks —

Part 1: Overview

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1 Scope

This document provides background about existing methods to assess the robustness of neural networks.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
artificial intelligence
AI
<system>capability of an engineered system to acquire, process and apply knowledge and skills

3.2
field trial
trial of a new system in actual situations for which it is intended (potentially with a restricted user group)

Note 1 to entry: Situation encompasses environment and process of usage.

3.3
input data
data for which a deployed machine learning model calculates a predicted output or inference

Note 1 to entry: Input data is also referred to by machine learning practitioners as out-of-sample data, new data and production data.

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