

English version

Artificial Intelligence (AI) - Assessment of the robustness
of neural networks - Part 1: Overview (ISO/IEC TR 24029-
1:2021)

Intelligence artificielle (IA) - Évaluation de la
robustesse des réseaux de neurones - Partie 1: Vue
d'ensemble (ISO/IEC TR 24029-1:2021)

Informationstechnik - Künstliche Intelligenz -
Bewertung der Robustheit neuronaler Netze (ISO/IEC
TR 24029-1:2021)

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European foreword

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Overview of the existing methods to assess the robustness of neural networks	3
4.1 General	3
4.1.1 Robustness concept	3
4.1.2 Typical workflow to assess robustness	3
4.2 Classification of methods	6
5 Statistical methods	7
5.1 General	7
5.2 Robustness metrics available using statistical methods	8
5.2.1 General	8
5.2.2 Examples of performance measures for interpolation	8
5.2.3 Examples of performance measures for classification	9
5.2.4 Other measures	13
5.3 Statistical methods to measure robustness of a neural network	14
5.3.1 General	14
5.3.2 Contrastive measures	14
6 Formal methods	14
6.1 General	14
6.2 Robustness goal achievable using formal methods	15
6.2.1 General	15
6.2.2 Interpolation stability	15
6.2.3 Maximum stable space for perturbation resistance	15
6.3 Conduct the testing using formal methods	16
6.3.1 Using uncertainty analysis to prove interpolation stability	16
6.3.2 Using solver to prove a maximum stable space property	16
6.3.3 Using optimization techniques to prove a maximum stable space property	16
6.3.4 Using abstract interpretation to prove a maximum stable space property	17
7 Empirical methods	17
7.1 General	17
7.2 Field trials	17
7.3 A posteriori testing	18
7.4 Benchmarking of neural networks	19
Annex A (informative) Data perturbation	20
Annex B (informative) Principle of abstract interpretation	25
Bibliography	26

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives or www.iec.ch/members_experts/refdocs).

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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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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.

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

Part 1: Overview

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.