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**Artificial Intelligence –
Life Cycle Processes and Quality Requirements –
Part 1: Quality Meta Model;
Text in English**

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Life Cycle Prozesse und Qualitätsanforderungen –
Teil 1: Qualitäts-Meta-Modell;
Text Englisch

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Partie 1: Métamodèle de qualité;
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Foreword

This DIN SPEC has been developed according to the PAS (Publicly Available Specification) procedure. The development of a DIN SPEC according to the PAS procedure is carried out in workshops and does not require the participation of all stakeholders.

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Introduction

Artificial Intelligence (AI) is a complex and rapidly developing field. It is a branch of computer science that covers tasks that are associated with human intelligence [1]. Especially, recent advances in the subfield Machine Learning (ML), a paradigm that enables systems to automatically improve their performance by observing data [2], have led to an increasing deployment of AI-based technologies by companies across almost all sectors.

AI components face traditional software quality problems and new issues that occur on the system level. The most severe novelty is that certain types of AI modules such as Artificial Neural Networks — their decisions and the underlying logic — often cannot be fully understood by code review. Also, non-stationary AI environments can lead to unpredictable decisions.

For these reasons, quality assessment of an AI module still poses a major challenge. It becomes more difficult to confirm, verify, and validate an AI module during conception, development, deployment, operation, and retirement which are wide-ranging tasks.

This document aims at providing a unified approach to secure AI quality. It is applicable to all AI components and goes beyond usual quality requirements in other branches of software development. Additional requirements address specific challenges related to the use of AI modules such as the composition of data sets, model selection, and non-stationary environments. The quality requirements arising from these new challenges are organized in the three quality pillars functionality & performance, robustness, and comprehensibility.

This document introduces an AI quality metamodel to outline key aspects of AI quality including the previously mentioned AI quality pillars. For AI quality analysis, an approach for risk evaluation and a suitable software life cycle are provided. The given AI life cycle is consistent with the international standard for systems and software engineering [3]. The second part of this specification, DIN SPEC 92001-2, provides specific AI quality requirements.

1 Scope

1.1 Purpose

The purpose of this document is to establish a quality-assuring and transparent life cycle of AI modules. Critical quality criteria are identified and AI-specific problems are addressed. To achieve this, this document presents a set of quality requirements that are structured in an AI specific quality metamodel.

It is important to note that not all AI modules impose the same quality requirements. Therefore, this document proposes the differentiation between AI modules with regard to their safety, security, privacy, and ethical relevance. Safety, security, privacy, or ethical relevance of an AI module requires the consideration and satisfaction of all quality requirements, while these requirements are less strict, when this relevance is not given.

This document outlines and defines the three central quality pillars functionality & performance, robustness, and comprehensibility. Note that these pillars are not fully disjoint, but the proposed distinction facilitates a structured listing of specific quality requirements. These quality requirements are also linked to different life cycle stages and life cycle processes. In this way, it becomes clear when and in which context certain requirements must be met. Furthermore, a distinction between quality requirements addressing the influencing factors model, data, platform, or environment of the AI module is made.

All considerations are gathered in the AI quality metamodel, which is introduced in section 4. It contains risk evaluation, the quality pillars, and life cycle stages and processes. Furthermore, the differences between model, data, platform, and environment are defined. In DIN SPEC 92001-2 AI specific requirements are given with respect to the different aspects of the AI quality metamodel.

1.2 Field of Application

This document applies to all life cycle stages of an AI module — concept, development, deployment, operation, and retirement — and addresses a variety of different life cycle processes. Due to the fact that AI technologies are used for a wide range of different tasks, this document is aimed at not only one particular field but applies to companies and AI products across all sectors.

This document applies to all kinds of AI modules including ML and expert systems.

1.3 Limitations

This document does not define or list algorithms, methods, or technologies which are part of AI. Hence, the user of this document is required to evaluate whether the given AI quality metamodel and the associated AI quality requirements apply.

While requiring an evaluation of ethical conduct in the development of an AI module, this document does not provide any specific requirements that define ethical conduct.

The software life cycle considerations in this document are compatible with ISO/IEC/IEEE 12207:2017, Systems and software engineering — Software life cycle processes [3]. This document explains AI specific terms, definitions, or processes.

This document proposes the separation between AI modules with high and low risk concerning safety, security, privacy, and ethical relevance. It also provides relevant aspects in the context of risk evaluation. This document does neither establish a precise risk evaluation process, nor an ethical design framework. It is, however, constrained by each institution's ethical code of conduct. Compliance with regulations is presumed. Furthermore, the stakeholders of this document are required to assess their AI module's risk profile.

The quality requirements listed in DIN SPEC 92001-2 are not domain specific. There is room for the extension of the requirements given in DIN SPEC 92001-2 to specific fields of application of AI in a subsequent standardization step.

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.

DIN and DKE maintain terminological databases for use in standardization at the following addresses:

- DIN-TERMinologieportal: available at <https://www.din.de/go/din-term>
- DKE-IEV: available at <http://www.dke.de/DKE-IEV>

3.1

artificial intelligence

AI

capability of a system to solve problems by emulating concepts that are generally associated with intelligent behaviour

3.2

artificial intelligence (AI) module

software module consisting of AI algorithms

3.3

availability

<accessibility/usability> property of being accessible and useable upon demand by an authorized entity

[SOURCE: ISO/TS 21089:2018]

3.4

comfort module

software module that has no safety or security relevance

3.5

component

non-system level element that is logically and technically separable and is comprised of more than one hardware part or of one or more software units

Note 1 to entry: A component is a part of a system.

[SOURCE: ISO 26262-1:2011]

3.6

confidentiality

<not disclosed> property that information is not made available or disclosed to unauthorized individuals, entities, or processes

Note 1 to entry: Data confidentiality is a synonym.

[SOURCE: ISO/TS 21089:2018, modified – Note 1 to entry has been added.]