International Standard

ISO/IEC 4879

Information technology — Quantum computing — Vocabulary

Technologies de l'information — Informatique quantique — Vocabulaire

First edition
2024-05

Reference number
ISO/IEC 4879:2024(en)

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Published in Switzerland

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Introduction

For most of computing history, the foundational hardware technology has been binary digital transistor logic. In such digital systems, data and programs represented as binary classical digits (bits) are encoded into physical transistors that have and can switch between two definite internal states: on and off. The field of quantum computing introduces a new approach to the underlying computing hardware by shifting from classical logic ("on" or "off") to a quantum logic where the "quantum bits" or "qubits" (the simplest units of quantum information) are encoded into physical registers that exhibit quantum-mechanical phenomena such as superposition and entanglement.

This shift from the classical digital representation found in today's conventional computers to a quantum digital representation in tomorrow's computers is expected to bring increases in computing power and new, innovative software applications, allowing us to tackle more complex computational problems and carry out powerful analysis of more complex data patterns that are already challenging or impossible for today's technology. Quantum computing holds the potential to revolutionize fields from chemistry and logistics to finance and physics.

However, the increase in power and capability that quantum computing will provide, will also pose an important security threat once quantum computers become large enough (or cryptographically relevant, as it is sometimes described). As strong as today's cryptographic mechanisms have been against conventional computers, almost all cryptographic protocols used are vulnerable to quantum-computing-based attacks with known algorithms. This widely known risk associated with the power of quantum computing is very concerning for governments, institutions and individuals whose encrypted data are safe today, but may become decryptable once quantum computers reach large enough size.

This document aims to assist in the understanding of quantum computing concepts and the exchange of information.

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Information technology — Quantum computing — Vocabulary

1 Scope

This document defines terms commonly used in the field of quantum computing. This document is applicable to all types of organizations (e.g. commercial enterprises, government agencies, not-for-profit organizations) to exchange quantum computing concepts.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

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

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

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

3.1 Background

3.1.1
model
physical, mathematical, or otherwise appropriate representation of a system, entity, phenomenon, process or data

[SOURCE: ISO/IEC 22989:2022, 3.1.23, logical has been changed to appropriate]

3.1.2
model parameter
internal variable of a *model* (3.1.1) that affects how it computes its outputs

[SOURCE: ISO/IEC 22989:2022, 3.3.8]

3.1.3
machine learning
process of optimizing *model parameters* (3.1.2) through computational techniques, such that the model's behaviour reflects the data or experience

[SOURCE: ISO/IEC 22989:2022, 3.3.5]

3.1.4
simulator
device, computer program, or system that behaves or operates like a given system when provided a set of controlled inputs

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3750]

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