

Projekt-ID. SDG-M4

Synthetic Data Generator (SDG) – Validation and Self-Assessment Framework

Version: 2.0

Status: 100/100 Validiert

Executive Summary

The Validation and Self-Assessment Framework defines the continuous quality control and validation processes for synthetic datasets generated by the SDG. It ensures that all generated data meets strict diversity, plausibility, bias-resistance, and adversarial robustness standards, in full compliance with TBYD and MaxOne architectural principles.

Scope and Objective

This document details the architecture and operational workflows for validating synthetic data generated by the SDG. It ensures decentralized, fully auditable, and compliant validation at the point of generation.

Technical Background

Validation is a core operational function within the SDG framework, embedded natively at the edge. Validation operates without central aggregation, ensuring privacy and independence while maintaining auditability.

Core Validation Components

- Diversity Testing Module: Ensures wide coverage across domains, structures, and linguistic features.
- Plausibility Testing Module: Assesses data coherence, realism, and internal logic.
- Bias Detection Module: Identifies and flags systemic or inadvertent biases.
- Adversarial Robustness Module: Tests resilience against noise, perturbation, and targeted adversarial input.

Self-Assessment Mechanisms

The SDG incorporates automated, continuous self-assessment loops, including:

- Post-generation batch testing
- Real-time scoring and feedback loops

- Triggered re-generation if quality thresholds are not met
- Reporting of validation metrics to MaxAudit

Interfaces and Flows

Validated outputs are interfaced as follows:

- MaxTune receives validated data readiness notifications.
- MaxAudit receives full validation logs and event summaries.
- MaxReg (optional) ensures compliance against regulatory templates if configured.

Validation and Testing Criteria

Validation checkpoints include:

- Diversity Index compliance (\geq preset thresholds)
- Plausibility Rating (pass/fail scoring)
- Bias Anomaly Detection (trigger alert if bias exceeds thresholds)
- Robustness Stress Test (minimum attack resilience score)

Compliance and Auditability

All validation outputs are fully auditable under:

- GDPR / DSGVO standards
- ISO 27001 security principles
- TBYD 100/100 validation protocols
- MaxOne regulatory compliance interfaces