

Projekt-ID. SDG-M13

Synthetic Data Generator (SDG) – Adaptive Evolution – KPIs and Trigger Thresholds

Version: 2.0

Status: 100/100 Validiert

Executive Summary

This document defines the operational KPIs and trigger thresholds that govern adaptive evolution within the SDG architecture. These mechanisms ensure that the system remains resilient, robust, and compliant over time without requiring external intervention.

Scope and Objective

The objective of this document is to:

- Identify critical operational indicators
- Define automatic triggers for re-evaluation and evolution
- Provide auditable structures for monitoring adaptive decision processes

Adaptive Evolution KPIs

1. Synthetic Validity Degradation Rate

- Measured decline in SVS (Synthetic Validity Score) across revalidation cycles.

2. Bias Divergence Index

- Increase in demographic or feature-based bias post-validation.

3. Diversity Collapse Ratio

- Loss of variance across key dimensions relative to baseline diversity indices.

4. Adversarial Vulnerability Escalation

- Increase in success rates of adversarial attack simulations.

5. Drift Detection Coefficient

- Emergence of statistical drift between generated data and intended rule models.

Trigger Thresholds

- Synthetic Validity Degradation: $\geq 5\%$ over 2 validation cycles → Mandatory revalidation.
- Bias Divergence Index: $\geq 7\%$ shift in protected class balance → Initiate bias mitigation workflow.
- Diversity Collapse Ratio: $\geq 10\%$ drop in variance indices → Trigger template evaluation.
- Adversarial Vulnerability Escalation: $\geq 8\%$ success rate increase → Force security hardening.
- Drift Detection Coefficient: Significant ($> 3\sigma$) deviation from baseline → Quarantine and full audit.

Integration Points

The adaptive KPIs and triggers are monitored by:

- MaxAudit logging and tracking
- MaxControl policy enforcement engine
- MaxTune feedback and adjustment loops
- MaxOneOpen governance overlays

Compliance and Auditability

The KPI-driven evolution framework is compliant with:

- EU AI Act (adaptive risk management requirements)
- ISO 27001 (continuous improvement cycles)
- TBYD 100/100 Validation and Evolution Systems