# Paradigm Shift in Source Code Translation Approaches: An AI use in Code Translation Tasks

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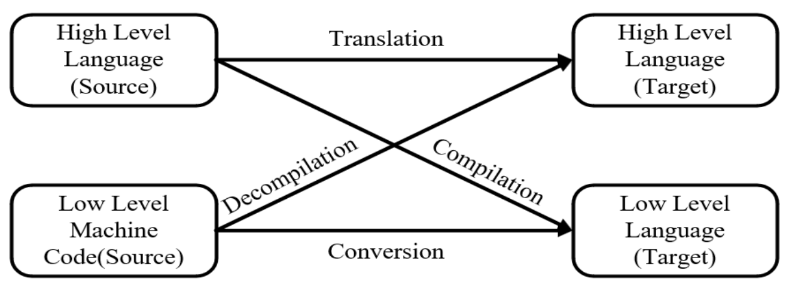
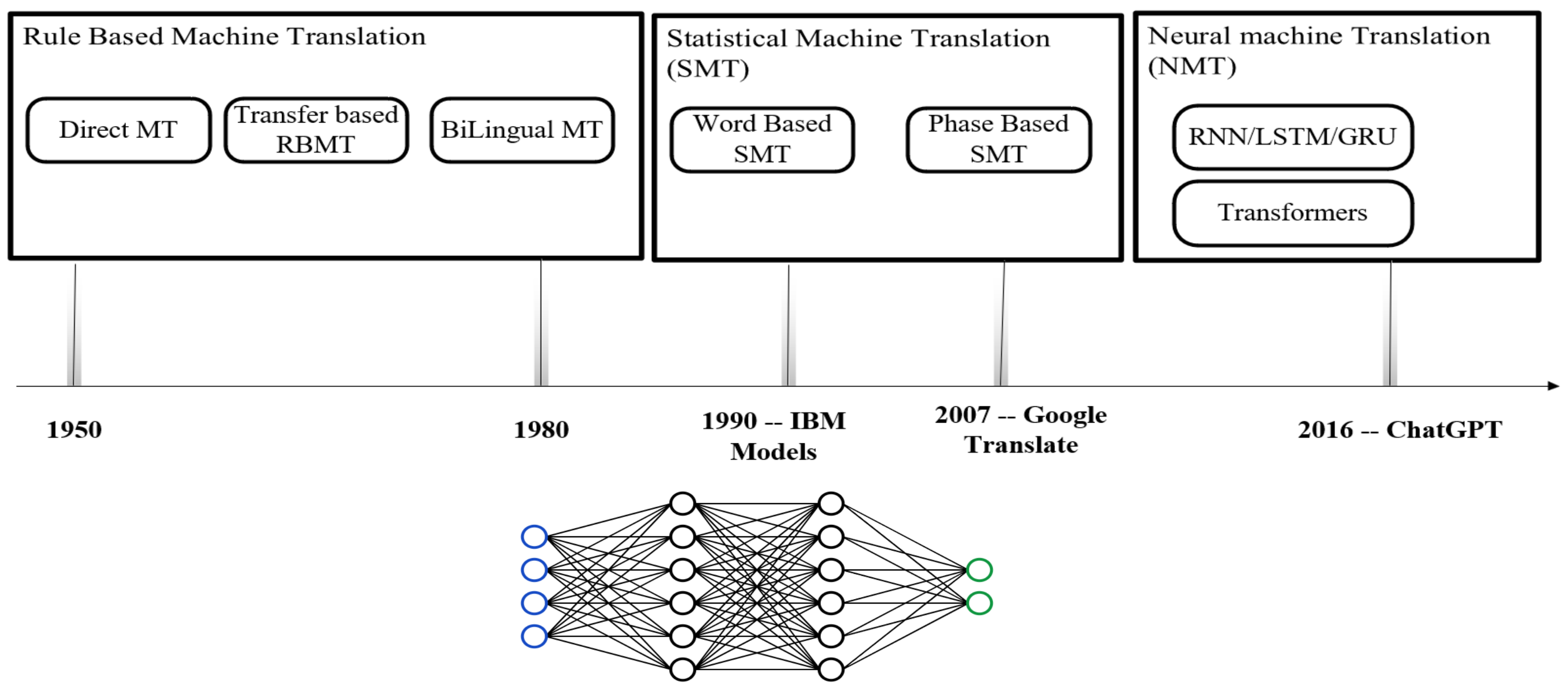
## 1 EVOLUTION SOURCE CODE TRANSLATION APPROACHES:

### Approaches used in Source Code Translation

**Statistical Based Approaches**

Stratarchical Machine Translation (SMT)
Hidden Markov Modelling in SMT
Syntax Based SMT
PBSMT (Phrase Based Statistical Machine Translation)


High Level Language (Source)
Translation
High Level Language (Target)
Decompilation
Compilation
Low Level Machine Code(Source)
Conversion
Low Level Language (Target)



**Deep Learning - Machine Translation**

Neural Machine Translation (NMT)
TransCoder by Meta(FaceBook)
ChatGPT3.5/4 (OpenAI)
CodeConvert
Google BARD

**AI Models Used in Source Code Translation**

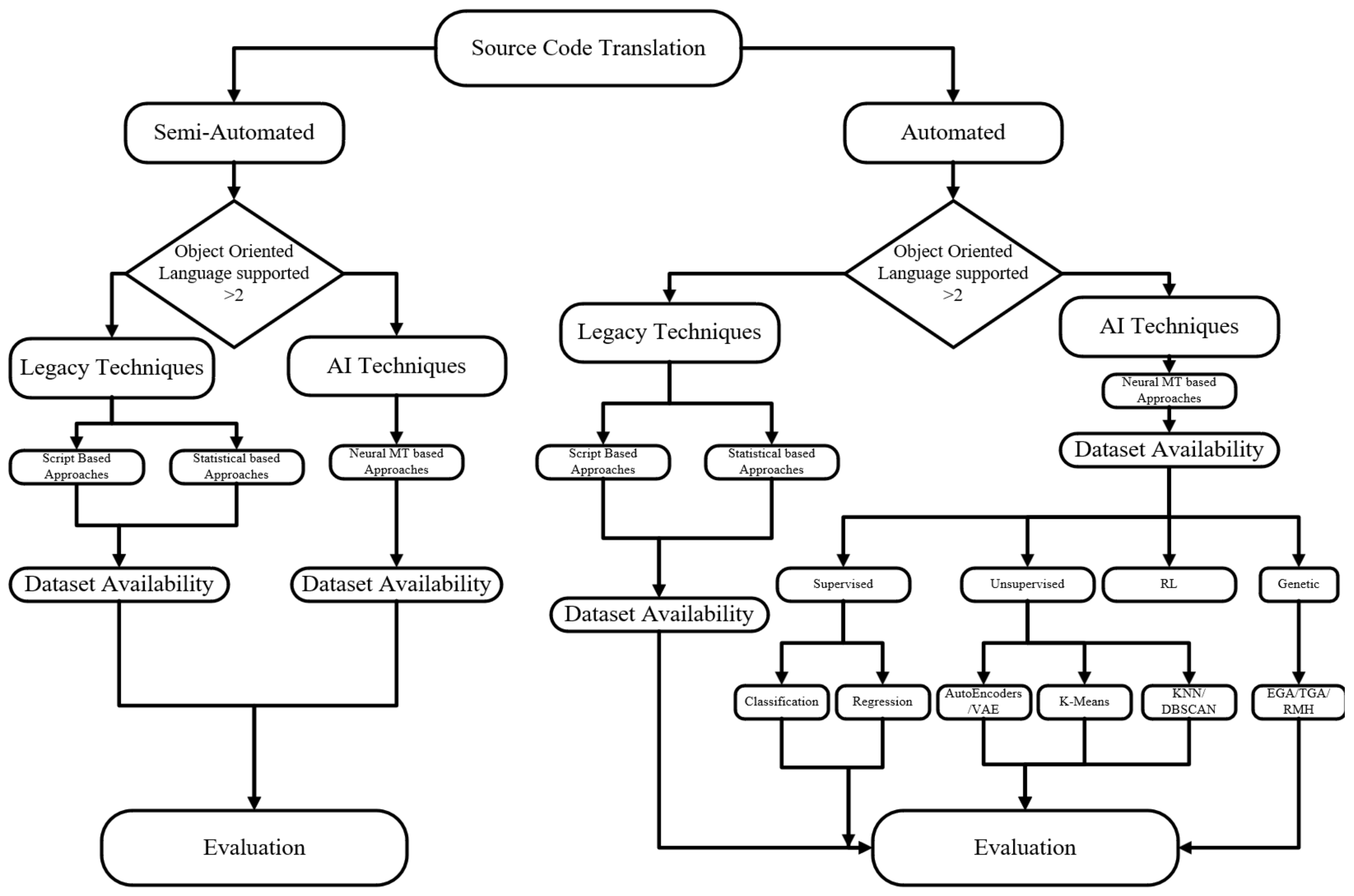
OpenAI Codex(Natural Language to Code)
CodeBERT
CodeT5
CodeGen
CodeLLAMA (LLM for Code-Generation Tasks)

## 2 CATEGORIZATION OF SOURCE CODE TRANSLATION TECHNIQUES:

### Overview of Source Code Translation Approaches

**Source Code Translation Approaches : A Taxonomy**

Categorized into semi-automated or fully automated based on our SLR findings
Subcategories include, Statistical Based (SMT), AI based(NMT)
Further AI based techniques are classified as supervised, semi-supervised and unsupervised

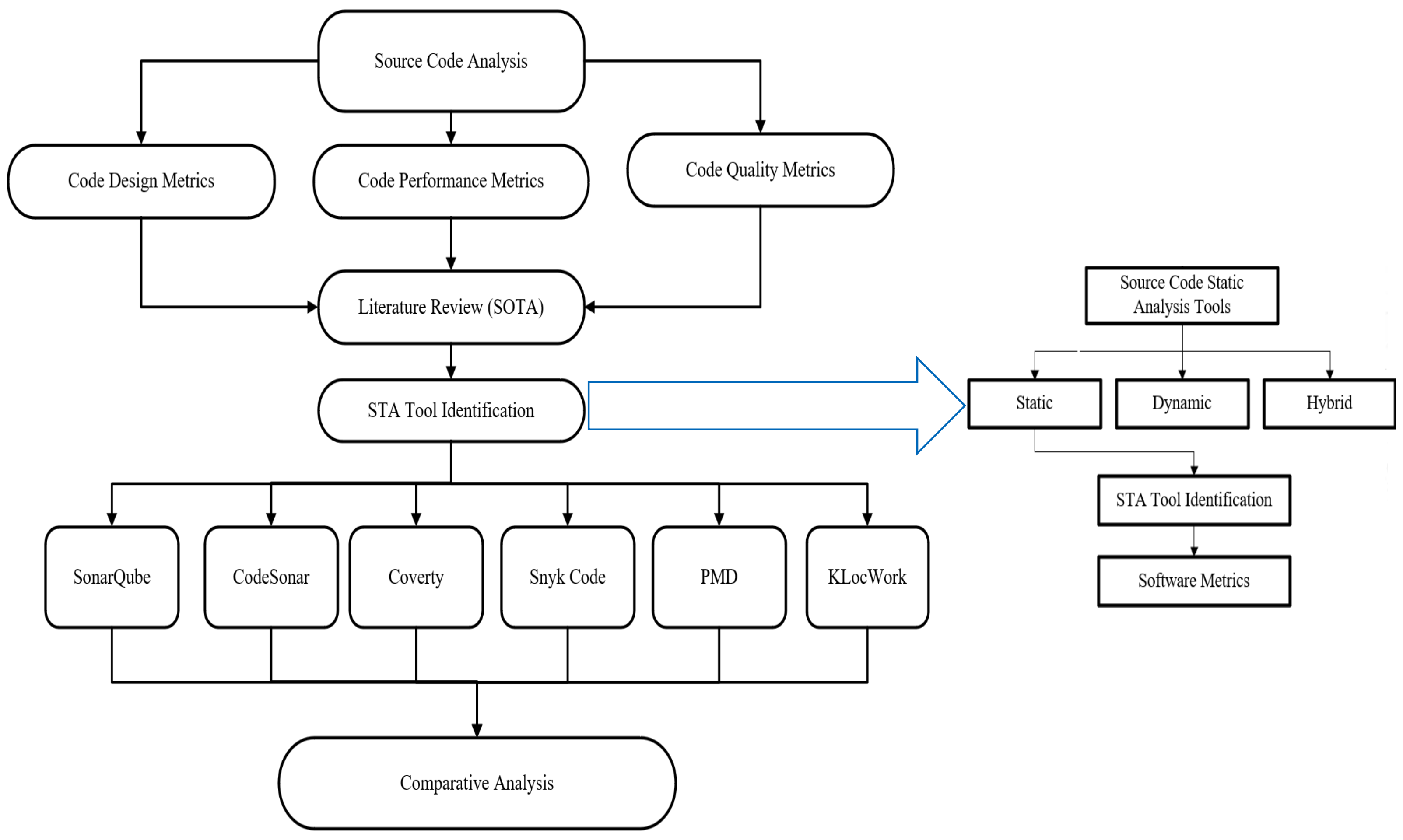


## 3 EVALUATION OF MACHINE TRANSLATED SOURCE CODE:

### Evaluation of Source Code Quality using Static Analysis Tools

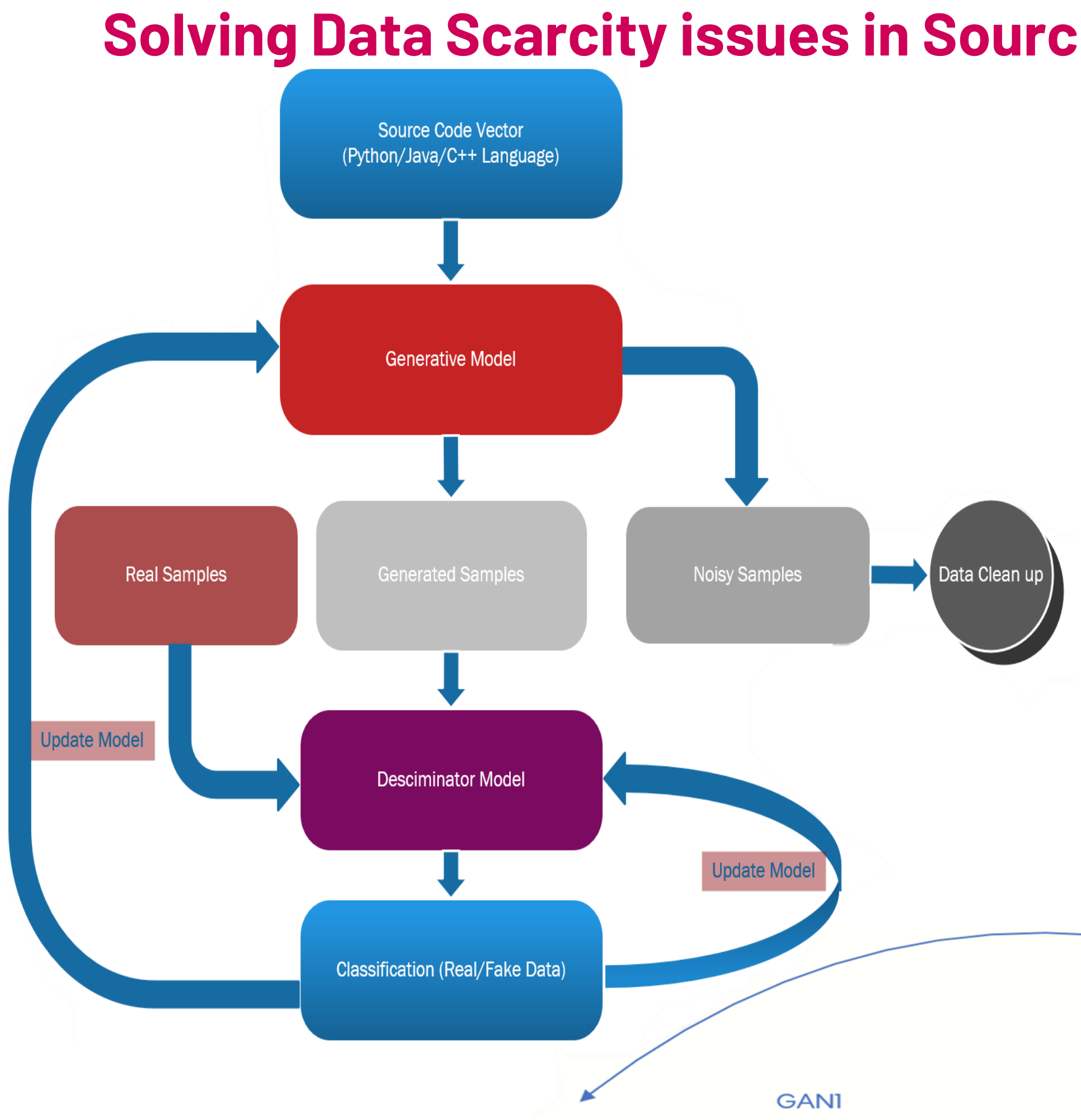
**Motivation**

No universal metric exists for Translated Code Quality (CodeBLEU, FE) to identify quality of automated output from AI based tools.
Static Analysis Tools use on translated code.
Checking for rules (maintainability, exceptions, buffer flow etc.)
Checking for Dataflow, Syntax errors, Model Checking, Compilation issues.
Can be added as part of full E2E flow for source code translation framework.



## 4 GENAI (GENERATIVE AI) USE IN CREATION OF BENCHMARK FOR TRAINING AND EVALUATION:

### Solving Data Scarcity issues in Source code Translation

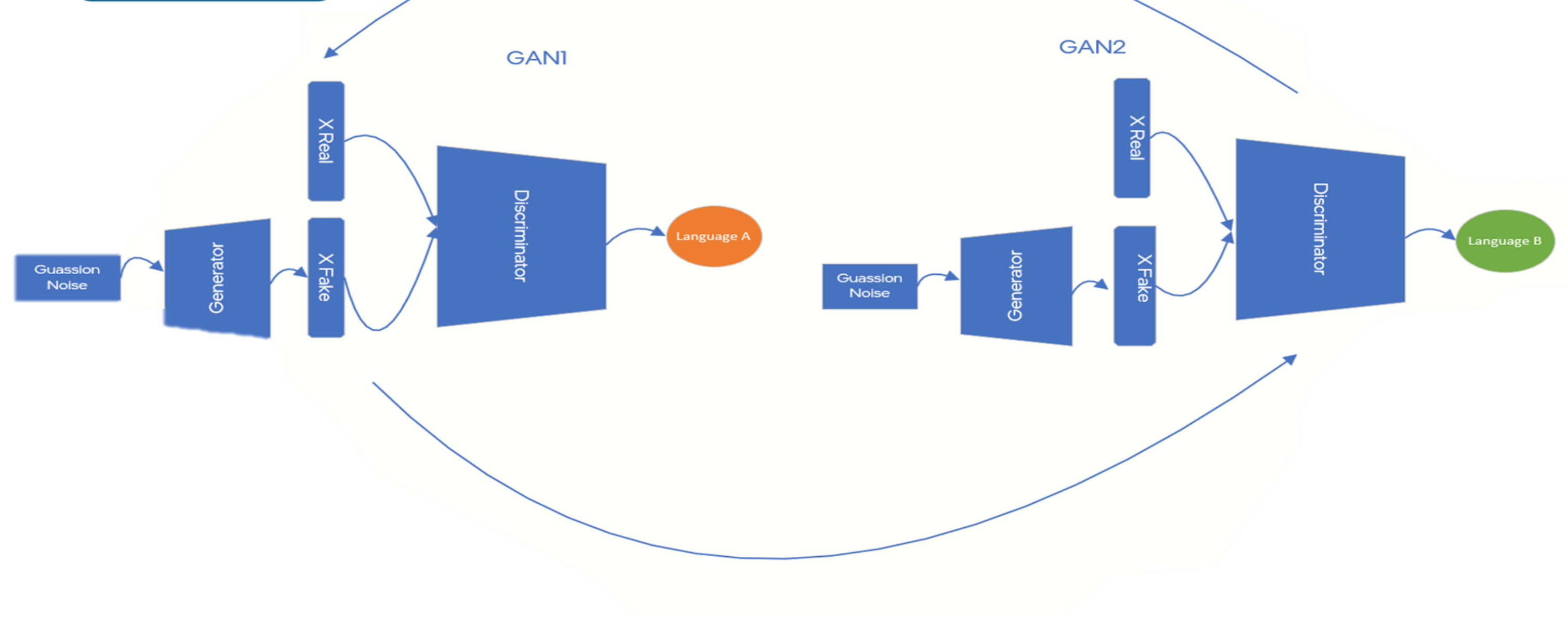


**Real Data can be:**

Expensive and time consuming
Has privacy issues
Has Safety issues
Should be updated real time with feedbacks.
Data cleanup can be tedious .

**Synthetic Data Generation:**

Uses Gen AI Approach (GAN, Cyclic GAN)
Easy to generate (match original dist)
Safe to use
No privacy issues
Successful in Image generation.
Source code data gen is under-explored



Cyclic GAN for Source Code Data

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