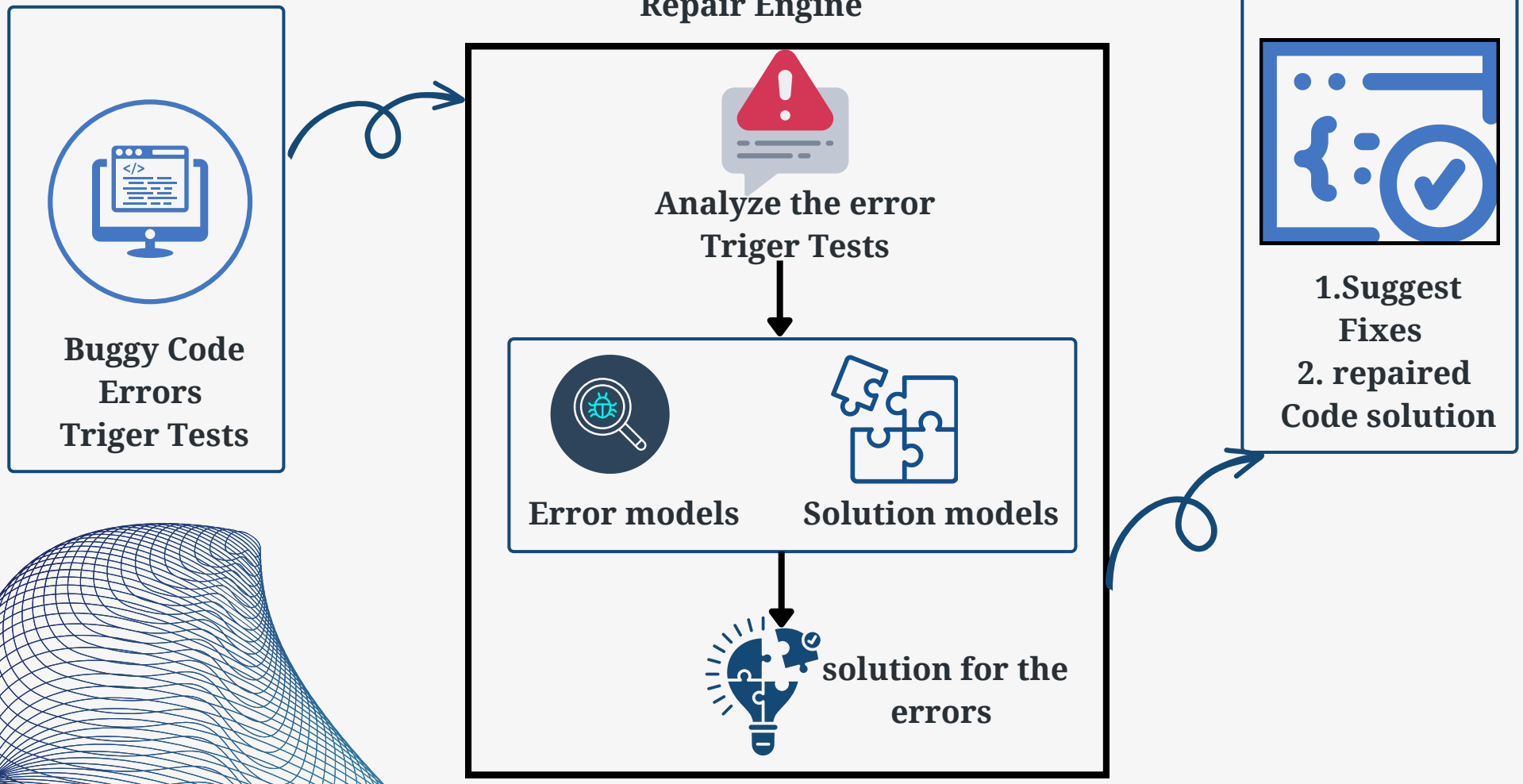
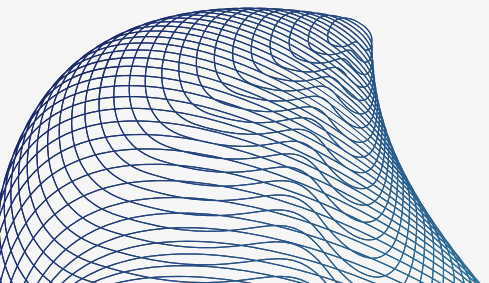
# Module 2:

# Repair the Program



# RESEARCH GAP

- **Insufficient Research**: Lack of comprehensive study on LLM-based function-level APR.
- **Performance Loss**: Significant performance drop in function-level APR.
- **Few-Shot Learning**: Effectiveness in function-level APR not well-validated.
- **Auxiliary Information**: Underexplored use of bug reports and tests for repair.
- **Costly Techniques**: Need for more cost-effective function-level fault localization.
- **Limited Techniques**: Need for practical LLM-based function-level APR methods.

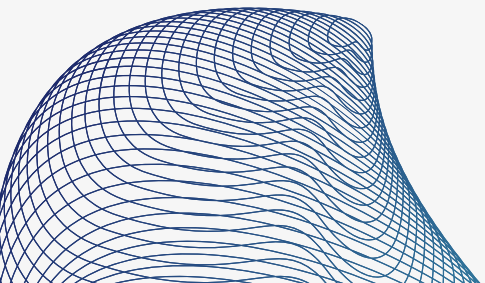


# SOLUTION IN DETAIL (CONTD.)

## Repair the Program

- The core of Module 2 is the "**Suggest Fixes and Rewritten Code**" component. It suggests specific corrections for the code, provides guidance on making these corrections, and, in some cases, offers entirely rewritten code segments to illustrate the necessary changes.

- The "**Repair Engine**" is responsible for generating the suggested fixes, guidance, and rewritten code. It uses few-shot learning mechanism and logics to determine how the code should be corrected and improved



# REPAIR MODULE OVERALL MODELS ARCHITECTURE

## Suggestion Model

Buggy Code
Trigger Test
Error Message

GPT 3.5 Turbo

## Repair Suggestions

Repair Suggestion 1

Repair Suggestion 2

Repair Suggestion 3

## Patch Generation Model

Buggy Code

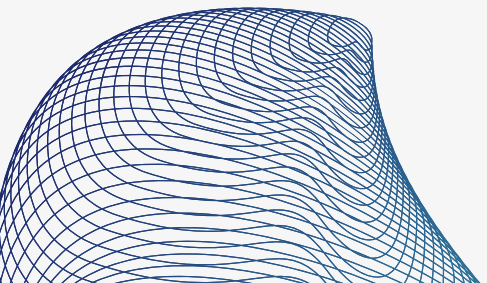
Repair Suggestion

open-source
Magicoder model

Fixed Code

Fixed Code

Fixed Code



# EVALUTION

## Data Set Format

| Dataset | Project | # Bugs | SF Bugs |
|---|---|---|---|
| *Defects4j 1.2* | Chart | 25 | 16 |
| | Closure | 140 | 105 |
| | Lang | 56 | 42 |
| | Math | 102 | 74 |
| | Mockito | 30 | 24 |
| | Time | 22 | 16 |
| *Defects4j 2.0* | Cli | 30 | 28 |
| | Codec | 13 | 11 |
| | Collections | 2 | 1 |
| | Compress | 40 | 36 |
| | Csv | 13 | 12 |
| | Gson | 12 | 9 |
| | JacksonCore | 18 | 13 |
| | JacksonDatabind | 85 | 67 |
| | JacksonXml | 5 | 5 |
| | Jsoup | 58 | 53 |
| | JxPath | 14 | 10 |
| **Overall** | | 665 | 522 |

# MODELS EVALUTION

## SF Bugs Plausible Fixes

| | GPT-3.5-Turbo | Coddegen | Our Repair module |
|---|---|---|---|
| Chart | 12 | 11 | 14 |
| Closure | 40 | 30 | 56 |
| Lang | 19 | 25 | 32 |
| Math | 48 | 43 | 55 |
| Mockito | 8 | 8 | 12 |
| Time | 7 | 5 | 7 |
| Cli | 16 | 13 | 19 |
| Codec | 8 | 5 | 11 |
| Collections | 0 | 1 | 1 |
| Compress | 21 | 22 | 28 |
| Csv | 10 | 9 | 11 |
| Gson | 6 | 8 | 9 |
| JacksonCore | 9 | 6 | 10 |
| JacksonDatabinc | 30 | 28 | 45 |
| JacksonXml | 3 | 1 | 3 |
| Jsoup | 34 | 35 | 39 |
| JxPath | 2 | 4 | 5 |
| | 273 | 254 | 357 |

## Model Accuracy

| Model | Accuracy |
|---|---|
| **GPT-3.5-Turb** | 52.2% |
| **Coddegen** | 48.6% |
| **Our Repair modul** | 71.2% |

# NOVELTY

- **Advanced Few-Shot Learning**: Integrated advanced few-shot learning mechanisms to boost repair effectiveness.

- **Auxiliary Information Integration**: Utilized repair-relevant information, such as bug reports and trigger tests, to improve repair accuracy and practicality.