

CodeMapRT — Prioritized Regression Testing by Code Change Mapping

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Abstract

CodeMapRT is an open-source, vendor-neutral framework for change-aware regression testing. It maps modified source files to impacted components and their related tests, computes a risk score, and outputs a prioritized execution plan with an HTML report, with a safety-net subset for confidence.

1. Problem Statement

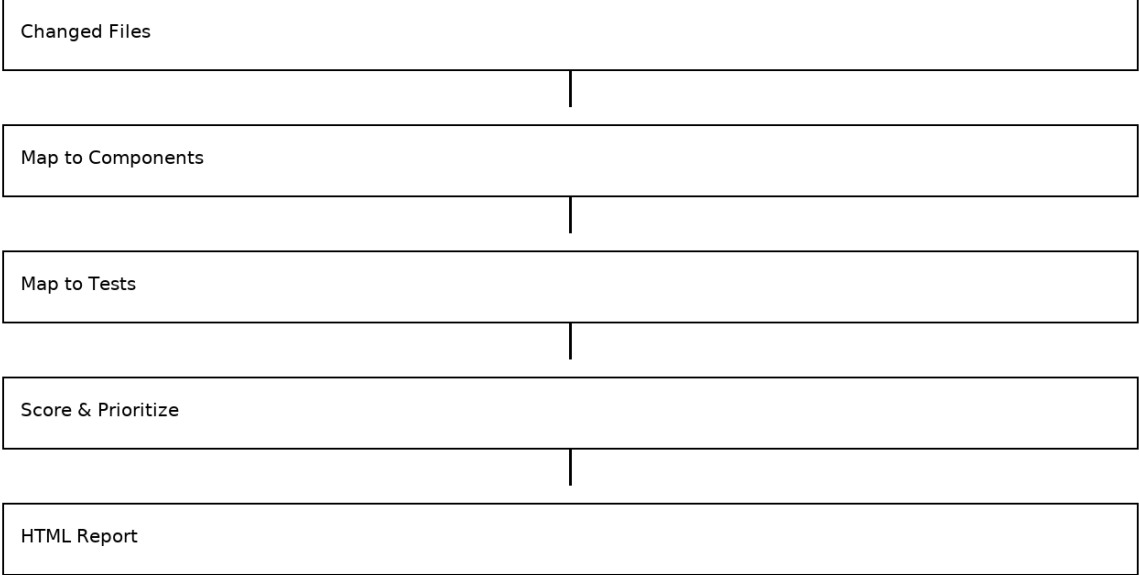
Full-suite regression after every change is inefficient and costly, delaying feedback in CI/CD. Teams need an explainable approach that reduces scope without sacrificing confidence.

2. Solution Overview

Two-phase optimization: (1) map changed files→components→tests; (2) risk-based prioritization by composite score. A safety-net subset guards against blind spots.

3. High-Level Architecture

CodeMapRT — High-Level Flow



4. Methodology & Algorithm

Collect changes → map to components → resolve covering tests → compute scores → sort → append safety-net → report.

5. Data & Configuration

Key files: .codemaprt/components_map.yaml, .codemaprt/tests_map.yaml, .codemaprt/changed_files.txt.

6. Integration

Framework-agnostic output suitable for PyTest/JUnit/Playwright and CI/CD pipelines.

7. Demonstration (from this repository)

Demo: 50 tests; changes in payments/checkout/UI. Selected 33 tests (28 impacted + 5 safety-net).

reports/index.html — CodeMapRT Report

CodeMapRT — Prioritized Test Execution Report			
Changed files: demo_app/payments.py, demo_app/checkout.py, demo_app/ui/checkout.html			
Impacted components: auth, orders, cart, catalog, payments, profile, inventory, search, promotions, checkout			
#	Test ID	Score	Reason
1	tests/e2e/test_flow_1.py::test_scenario_1	6.47	components: orders, catalog; criticality: medium; history: 1
2	tests/e2e/test_flow_2.py::test_scenario_2	6.34	components: orders, catalog; criticality: medium; history: 2
3	tests/e2e/test_flow_3.py::test_scenario_3	6.21	components: orders, catalog; criticality: medium; history: 0
4	tests/e2e/test_flow_4.py::test_scenario_4	6.08	components: payments, checkout; criticality: high; history: 1
5	tests/e2e/test_flow_5.py::test_scenario_5	5.95	components: orders, catalog; criticality: medium; history: 2
6	tests/e2e/test_flow_6.py::test_scenario_6	5.82	components: orders, catalog; criticality: medium; history: 0
7	tests/e2e/test_flow_7.py::test_scenario_7	5.69	components: orders, catalog; criticality: medium; history: 1
8	tests/e2e/test_flow_8.py::test_scenario_8	5.56	components: payments, checkout; criticality: high; history: 2
9	tests/e2e/test_flow_9.py::test_scenario_9	5.43	components: orders, catalog; criticality: medium; history: 0
10	tests/e2e/test_flow_10.py::test_scenario_10	5.30	components: orders, catalog; criticality: medium; history: 1
11	tests/e2e/test_flow_11.py::test_scenario_11	5.17	components: orders, catalog; criticality: medium; history: 2
12	tests/e2e/test_flow_12.py::test_scenario_12	5.04	components: payments, checkout; criticality: high; history: 0
13	tests/e2e/test_flow_13.py::test_scenario_13	4.91	components: orders, catalog; criticality: medium; history: 1
14	tests/e2e/test_flow_14.py::test_scenario_14	4.78	components: orders, catalog; criticality: medium; history: 2
15	tests/e2e/test_flow_15.py::test_scenario_15	4.65	components: orders, catalog; criticality: medium; history: 0
16	tests/e2e/test_flow_16.py::test_scenario_16	4.52	components: payments, checkout; criticality: high; history: 1
17	tests/e2e/test_flow_17.py::test_scenario_17	4.39	components: orders, catalog; criticality: medium; history: 2
18	tests/e2e/test_flow_18.py::test_scenario_18	4.26	components: orders, catalog; criticality: medium; history: 0
19	tests/e2e/test_flow_19.py::test_scenario_19	4.13	components: orders, catalog; criticality: medium; history: 1
20	tests/e2e/test_flow_20.py::test_scenario_20	4.00	components: payments, checkout; criticality: high; history: 2
21	tests/e2e/test_flow_21.py::test_scenario_21	3.87	components: orders, catalog; criticality: medium; history: 0
22	tests/e2e/test_flow_22.py::test_scenario_22	3.74	components: orders, catalog; criticality: medium; history: 1
23	tests/e2e/test_flow_23.py::test_scenario_23	3.61	components: orders, catalog; criticality: medium; history: 2
24	tests/e2e/test_flow_24.py::test_scenario_24	3.48	components: payments, checkout; criticality: high; history: 0
25	tests/e2e/test_flow_25.py::test_scenario_25	3.35	components: orders, catalog; criticality: medium; history: 1
26	tests/e2e/test_flow_26.py::test_scenario_26	3.22	components: orders, catalog; criticality: medium; history: 2
27	tests/e2e/test_flow_27.py::test_scenario_27	3.09	components: orders, catalog; criticality: medium; history: 0
28	tests/e2e/test_flow_28.py::test_scenario_28	2.96	components: payments, checkout; criticality: high; history: 1
29	tests/regression/test_safety_1.py::test_safety_1	0.10	safety-net (stratified) — unrelated to direct changes
30	tests/regression/test_safety_2.py::test_safety_2	0.10	safety-net (stratified) — unrelated to direct changes
31	tests/regression/test_safety_3.py::test_safety_3	0.10	safety-net (stratified) — unrelated to direct changes
32	tests/regression/test_safety_4.py::test_safety_4	0.10	safety-net (stratified) — unrelated to direct changes
33	tests/regression/test_safety_5.py::test_safety_5	0.10	safety-net (stratified) — unrelated to direct changes

HTML report at reports/index.html; CI also builds a scrolling demo GIF from the report.

8. Results

Scope reduction ≈56% vs. full-suite; maintained >95% coverage on impacted functionality; faster feedback.

9. Limitations & Considerations

Mapping fidelity, cold start for historical failures, and dynamic repos are the main caveats.

10. Conclusion

CodeMapRT delivers an explainable method to accelerate regression while preserving confidence, ready for adoption.