**🔄 Iterative & Incremental Thesis Roadmap**

**Iteration Cycle Structure (3–4 months each)**

Each cycle (aligned roughly with a semester) includes:

1. **Baseline → Hypothesis**: Pick 1–2 weaknesses (e.g., false positives + prioritization).
2. **Prototype**: Implement ML/AI tweak (lightweight).
3. **Evaluate**: Run on sample repos → collect metrics.
4. **Refine/Integrate**: Adjust approach & merge with prior work.
5. **Document**: Update thesis + potential publication.

**📅 High-Level Iterations**

**Cycle 1 (Fall 2025) → *Exploration & First Prototype***

* Weakness focus:
  + Detection Engine (false positives)
  + Prioritization logic (static heuristics)
* Actions:
  + Collect baseline data from SonarQube.
  + Implement small ML prototype for FP reduction.
  + Add a naive ranking adjustment (e.g., based on commit frequency).
* Increment: **Prototype v0.1** (ML-enhanced SonarQube with tiny scope).

**Cycle 2 (Spring 2026) → *Refinement & Expansion***

* Weakness focus:
  + Detection Engine (improved ML w/ NLP embeddings)
  + Prioritization (feedback-driven ranking, developer history).
* Actions:
  + Expand dataset (multiple repos).
  + Add feedback loop (simulate developer validation from commit history).
  + Compare results vs Sonar baseline.
* Increment: **Prototype v0.2** (smarter detection + ranking).

**Cycle 3 (Summer 2026) → *Integration & Cross-Domain Synergy***

* Weakness focus:
  + Detection + Prioritization together.
  + Defect density mapping (overlay with bug history).
* Actions:
  + Integrate FP reduction + ranking into unified module.
  + Add defect density correlation → rank issues by likelihood of causing real bugs.
* Increment: **Prototype v0.3** (multi-domain improvement).

**Cycle 4 (Fall 2026) → *Stabilization & Thesis***

* Weakness focus:
  + End-to-end workflow (automation pipeline).
  + Behavioral ML patterns (detect suspicious dev issue patterns).
* Actions:
  + Integrate all prior improvements into one coherent tool.
  + Large-scale evaluation (Apache, Mozilla, Kubernetes).
  + Write dissertation + defense prep.
* Increment: **Prototype v1.0 (Research System)** + Thesis.