

# A Comprehensive Review and Comparison of Branch Prediction Techniques in Modern Computer Architectures

## Objective:

The objective of this research project is to conduct a literature review on the topic of branch prediction techniques in computer architecture. Branch prediction techniques aim to optimize the processor pipeline by minimizing the stalls caused by control hazards. This study will carefully characterize and compare a minimum of 10 different papers related to this topic, focusing on the various approaches and methodologies employed in these studies.

## Scope:

The literature review will cover a range of branch prediction techniques, including but not limited to:

1. Static branch prediction
2. Dynamic branch prediction
  - Bimodal branch prediction
  - Two-level adaptive branch prediction
  - Tournament predictors
3. Hybrid branch prediction techniques
4. Machine learning-based approaches
5. Neural branch prediction

## Methodology:

The research project will comprise the following steps:

1. Identify a minimum of 10 relevant research papers on branch prediction techniques in computer architecture.
2. Provide a 1-page summary for each selected paper, highlighting the key aspects of their respective methodologies and findings.
3. Conduct an 8-10 page discussion comparing the various approaches, their strengths, weaknesses, and potential trade-offs.
4. Suggest future research directions that could further advance the field of branch prediction in computer architecture.

## Expected Outcomes:

Upon completion of this research project, we expect to provide a comprehensive review of the current state of branch prediction techniques in computer architecture, identifying the most promising approaches and potential areas for future research.