ECE-585
COMPUTER ARCHITECTURE
FINAL PROJECT REPORT

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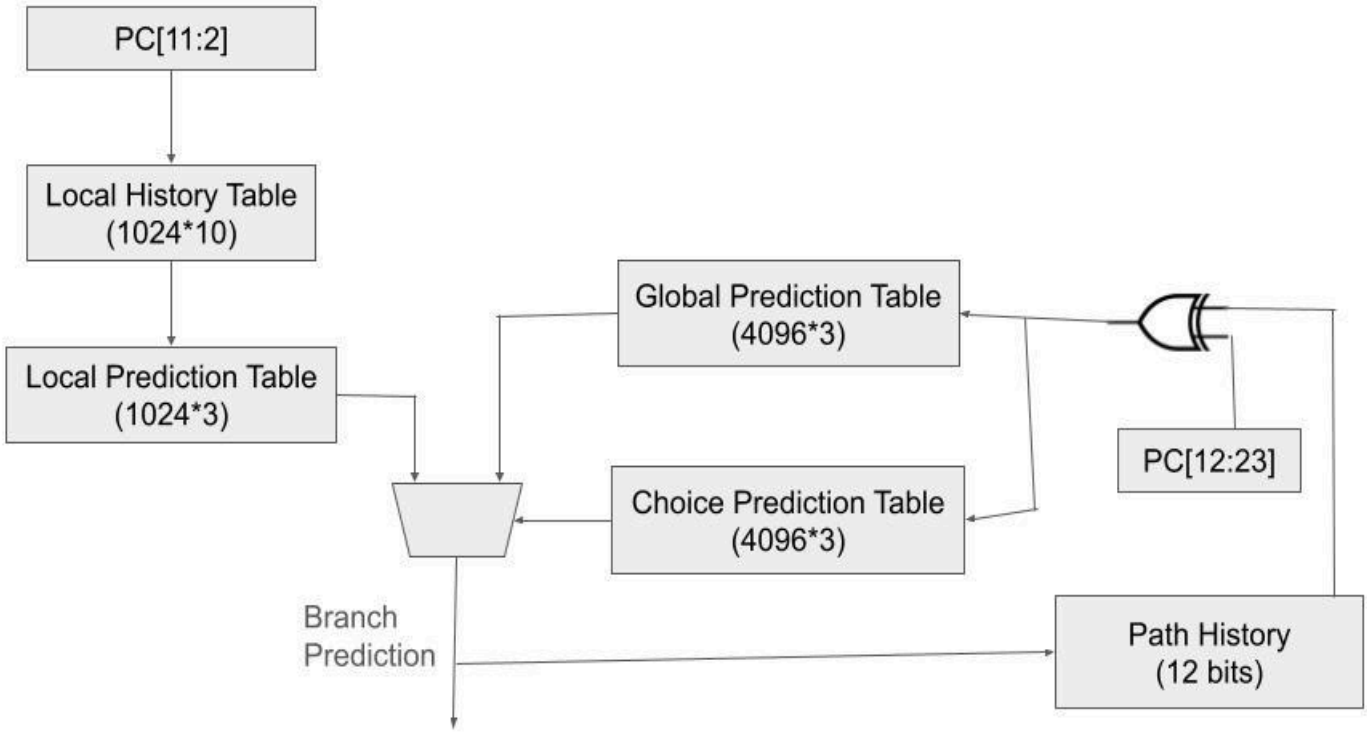
Overview:

The competition predictor is implemented as a variation of alpha predictor with the below 3 changes:

1. The index to select the global and choice prediction is xor of path history and higher order bits of PC - PC[23:12].
2. Increased the Choice prediction bits from 2 to 3 bits.
3. Increased the Global prediction bits from 2 to 3 bits.

Architecture Diagram:



Data structures:

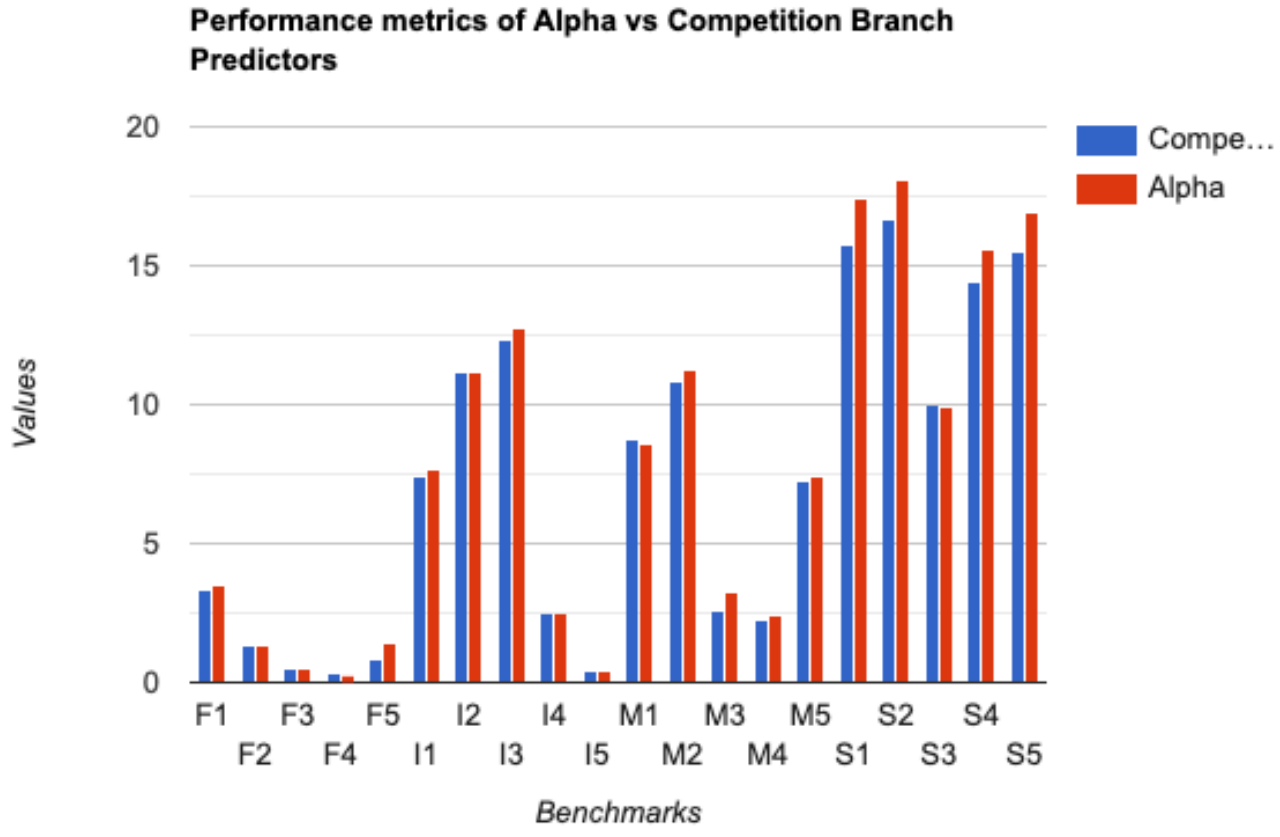
Local history table: 1K x 10 bits =10 Kib
Local predictors : 1K x 3 bits = 3 Kib
Global predictors : 4K x 3 bits = 12 Kib
Choice predictors : 4K x 3 bits = 12 Kib
Total = 39 Kib x 1 byte/8 bits = 4.875 KiB

Performance:

Both Alpha and Competition predictors are run across 20 different benchmarks and performance of competition predictor is better over a variety of benchmarks. The overall performance is compared using the Geometric mean of the results across all the benchmarks and the numbers are as follows:

Mean of alpha predictor across all benchmarks = **4.313**
Mean of Competition predictor = **4.048**

Benchmark trends are as follows:



Mispredict rates per benchmark:

Benchmarks	Mispredicts per 1000 instructions	
	Competition predictor	Alpha Predictor
FP-1	3.367	3.491
FP-2	1.305	1.324
FP-3	0.523	0.524
FP-4	0.297	0.276
FP-5	0.794	1.399
INT-1	7.394	7.699
INT-2	11.174	11.14
INT-3	12.312	12.712
INT-4	2.467	2.502
INT-5	0.434	0.42
MM-1	8.714	8.607
MM-2	10.87	11.273
MM-3	2.579	3.254
MM-4	2.276	2.403
MM-5	7.262	7.425
SERV-1	15.743	17.39
SERV-2	16.653	18.075
SERV-3	10.013	9.942
SERV-4	14.412	15.619
SERV-5	15.499	16.901