

NC State University
Department of Electrical and Computer Engineering
ECE 463/563: Fall 2019 (Dr. Huiyang Zhou)
Project #2: Branch Prediction

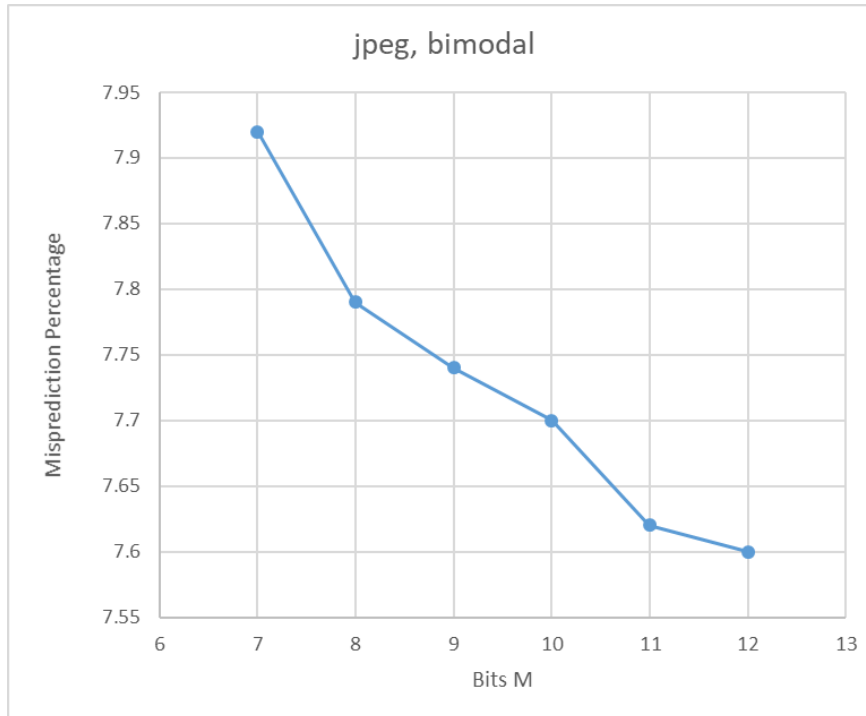
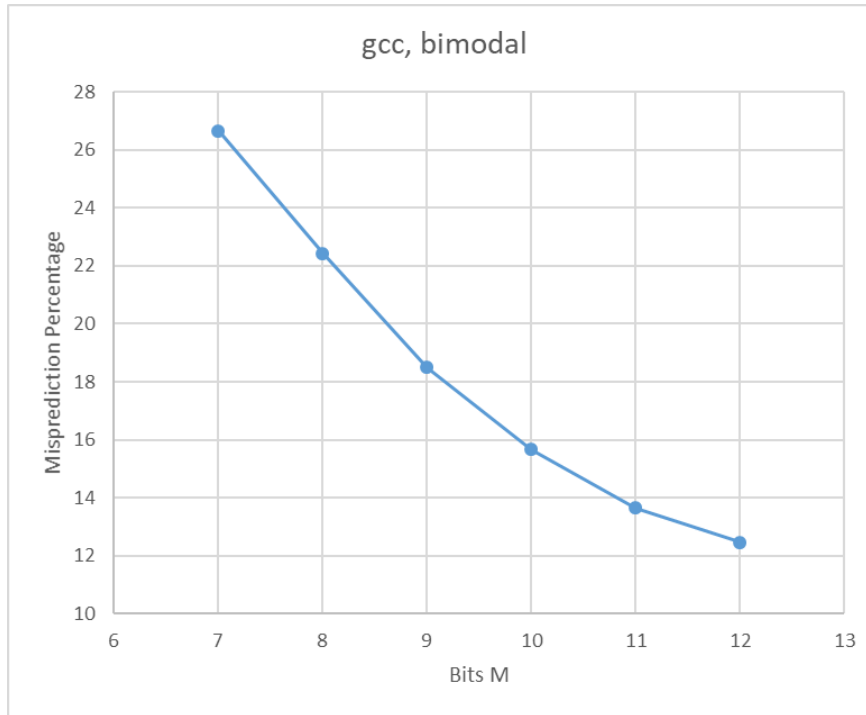
By
Daksh Kandpal

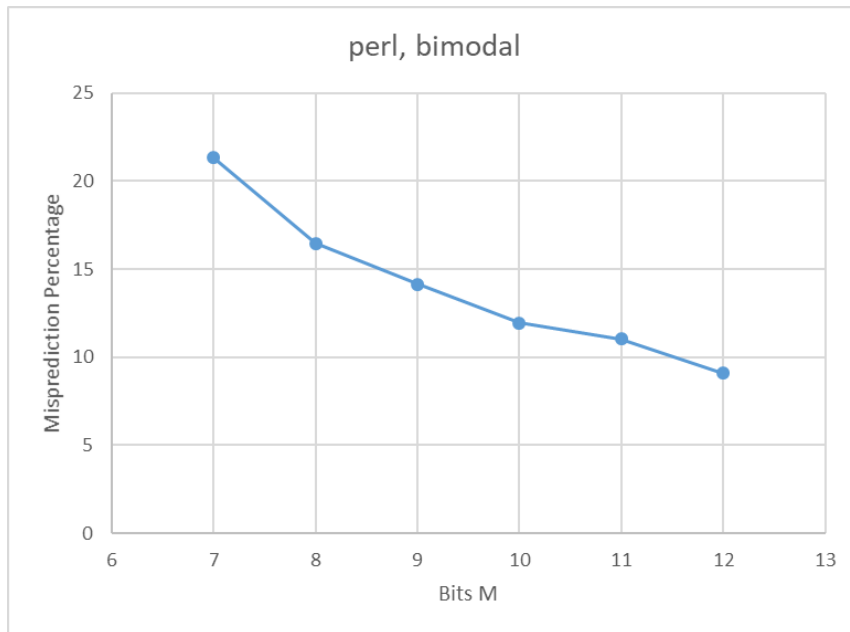
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Student’s Electronic Signature: Daksh Kandpal

Course Number: 563

Bimodal Branch Predictor:





Analysis:

From the graphs above, it is evident that for each of the given traces, the misprediction rate decreases with an increase in the number of PC bits (M here). The prediction accuracy keeps getting better as the PC bits increase until a point is reached where it plateaus, and no significant improvement is observed on adding hardware. For each of the given traces those points are as follows:

GCC:

For this trace the law of diminishing returns is observed at **M=13** at which point the misprediction rate is **11.72%**., after which point no significant improvement is observed.

M	Misprediction Rate (%)
7	26.65
8	22.43
9	18.49
10	15.67
11	13.65
12	12.47
13	11.72
14	11.37
15	11.30
16	11.21

JPEG:

For this trace the law of diminishing returns is observed at **M=12** at which point the misprediction rate is **7.6%.**, after which point no significant improvement is observed.

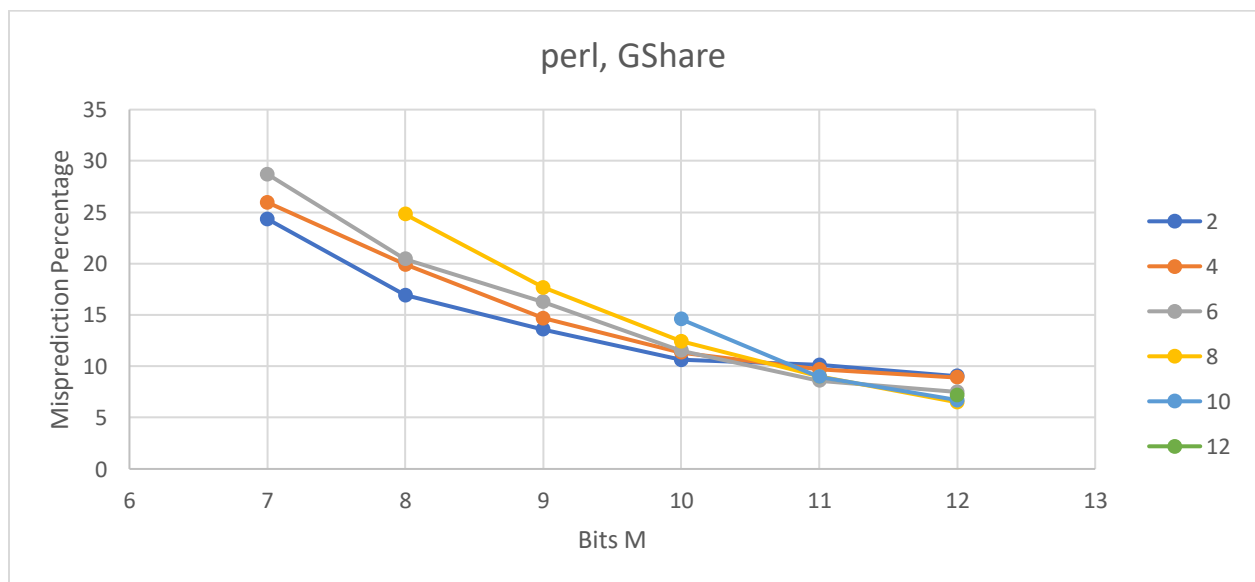
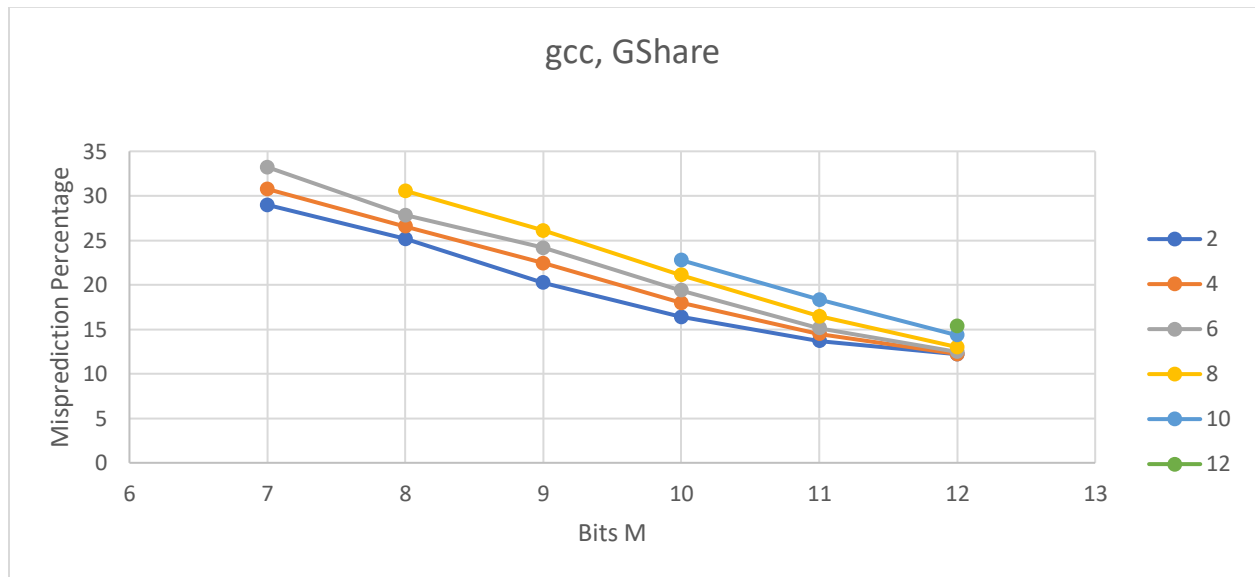
M	Misprediction Rate (%)
7	7.92
8	7.79
9	7.74
10	7.7
11	7.62
12	7.6
13	7.59
14	7.59

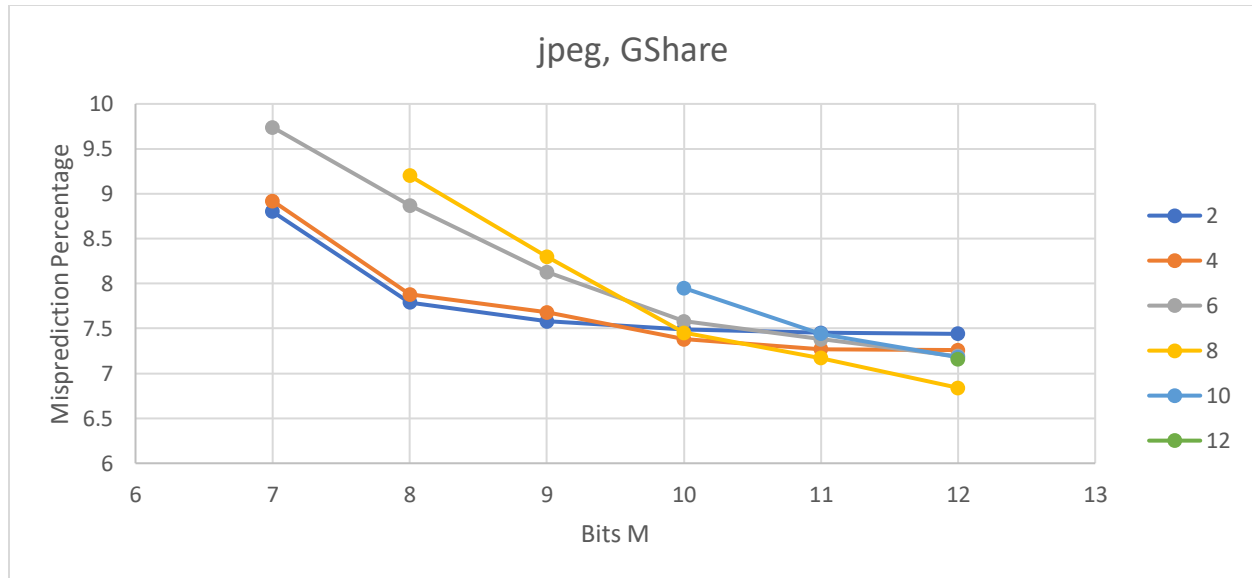
PERL:

For this trace the law of diminishing returns is observed at **M=13** at which point the misprediction rate is **8.92%.**, after which point no significant improvement is observed.

M	Misprediction Rate (%)
7	21.31
8	16.45
9	14.14
10	11.95
11	11.05
12	9.09
13	8.92
14	8.82
15	8.82

GShare Branch Predictor:





Analysis:

From the above graphs for each of the given traces, it is clear that increasing the number of PC bits while keeping the branch history register size constant leads to reduction in the misprediction rate. As was the case for Bimodal predictor, the improvement in accuracy with the increasing PC bits plateaus at some point after which no further significant improvement is observed.

The misprediction rates mentioned below are the lowest that were observed in the given domains of M and N respectively and thus further increasing the number of PC bits or number of branch history register bits doesn't serve any purpose. They are as follows:

GCC:

For this trace the law of diminishing returns is observed at **M=12 and N=2** at which point the misprediction rate observed is **12.2%**.

PERL:

For this trace the law of diminishing returns is observed at **M=12 and N=8** at which point the misprediction rate observed is **6.49%**.

JPEG:

For this trace the law of diminishing returns is observed at **M=12 and N=8** at which point the misprediction rate observed is **6.84%**.