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Lab 3 Branch Predictor
December 2 (Before Class)

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GSHARE

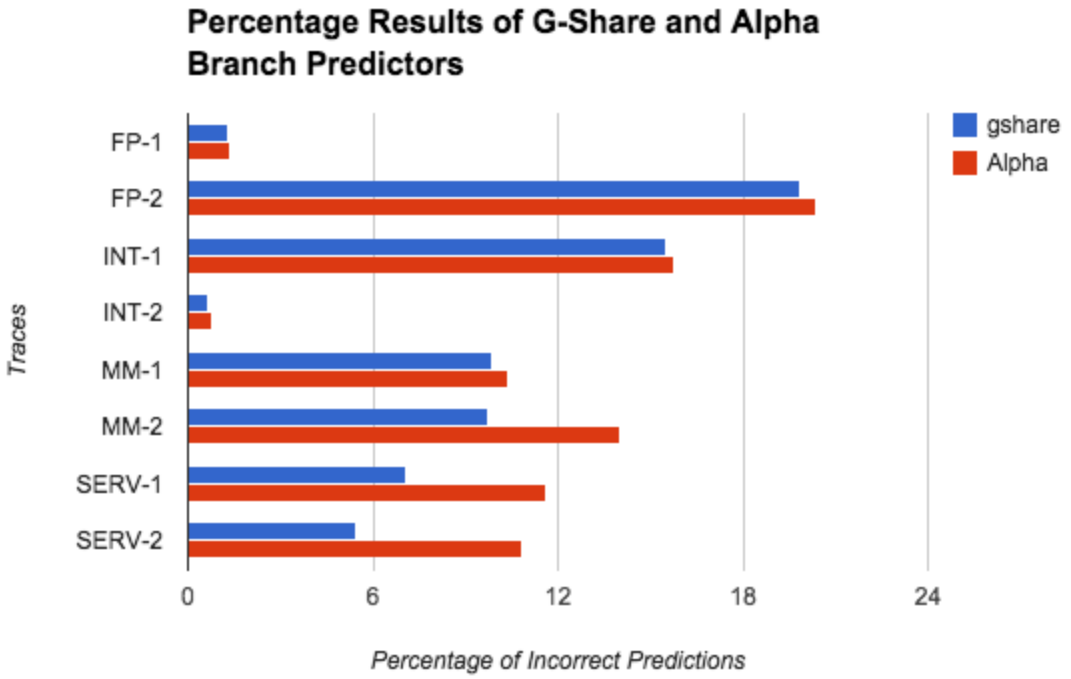
The gshare branch predictor is simple, yet extremely accurate. It is a two level active predictor that utilizes a globally shared history buffer and pattern history table. The prediction is made by looking up the entry in the history table given by the XOR of the global history with the program counter. The result is stored in a branch history table. The branch history table in our case is accessed via a 2-bit saturated counter; however, the type and size of the counter is editable.

ALPHA 21264 PREDICTOR (Tournament-style)

The Alpha 21264 Predictor is a complicated and more advanced predictor. The predictor is more advanced with respect to how it chooses its prediction. Three separate predictors are used in the Alpha 21264 predictor. The three predictors are editable and can be mixed and matched for optimal performance. Two predictors are used to predict if a branch will be taken or not taken. The third and last predictor is used to predict which of the two other predictors to choose. The result is then used to predict if the branch is taken or not taken. In our case, a 2-bit saturated counter was used for the predictors.

Table Percentage of Incorrect Predictions

	FP-1	FP-2	INT-1	INT-2	MM-1	MM-2	SERV-1	SERV-2	MEAN
gshare	1.323	19.835	15.495	0.663	9.883	9.761	7.091	5.439	8.686
Alpha	1.333	20.351	15.772	0.771	10.381	14.039	11.615	10.845	10.638



The results of our branch predictors are great compared to the default “Stupid Predictor”. The “Stupid Predictor” would always predict false, and the results where not acceptable. For instance, that predictor on the INT-2 trace showed a 94.492% miss rate, versus the 0.663% for the gshare and 0.771% for the Alpha. The gshare outperformed the Alpha on every trace, though some of the traces results were immensely close. For example, in the FP-1 trace, the gshare outperformed the Alpha by .01 percent.

We found it quite odd that the gshare predictor outperformed the Alpha on every single trace. Again, some were very close, but the gshare was better nonetheless. It is odd because the Alpha predictor has more data to work with, with respect to the amount of discrete components to the predictor and the logic behind it. It is known though that the gshare performs exceptionally well, even though its design is simple, but it should not completely outperform such an advanced predictor in every single case.

Alpha’s performance compared to gshare on some traces was considerably worse. For example, in the MM-2 trace, gshare was incorrect 9.761% of the time, where Alpha was incorrect 14.039% of the time. Alpha was 1.44 times worse compared to the gshare.

Overall, both predictors perform exceptionally better than the default “Stupid Predictor”. The gshare outperformed the alpha predictor on every trace. The worst trace was the FP-2, here the gshare was wrong 19.835% of the time, where Alpha was 20.351%.

Approximated and agreed-upon work distribution:

Ian Neal 53%
Cristobal Gallegos 47%