MaSiF: Machine Learning Guided Auto-tuning of Parallel Skeletons

Carefully tuning parallelisation parameters is essential

The best parameter value varies across programs on the same machine:

- pbzip2
- fibonacci

Programs share similarities. We can exploit this by learning how to optimise.

MaSiF searches for the best parallelisation parameters using Machine Learning

Step 1: Start point of search
Step 2: Try parameters in direction of most variation
Step n: Try parameters in direction of nth most variation

Parameter chosen is the best along the n directions, where the original space has a dimensionality larger than n

An automatic tuning technique is needed to do this.

We don’t know what the space looks like for a new program.

MaSiF uses Machine Learning to identify similar training programs to estimate how the space looks.

MaSiF computes search directions using Principal Components Analysis

Optimization Parameters
- Number of threads
- Type of queue
- Buffer size of queues
- Number of items in each batch
- Memory allocation alignment

We don’t know what the space looks like for a new program.

MaSiF searches for the best parallelisation parameters using Machine Learning

Step 1: Start point of search
Step 2: Try parameters in direction of most variation
Step n: Try parameters in direction of nth most variation

Parameter chosen is the best along the n directions, where the original space has a dimensionality larger than n

An automatic tuning technique is needed to do this.

We don’t know what the space looks like for a new program.

MaSiF uses Machine Learning to identify similar training programs to estimate how the space looks.

MaSiF computes search directions using Principal Components Analysis

88% of oracle performance (1.18x speedup over human expert) after exploring 0.45% of the space

MaSiF outperforms a human expert

Programs share similarities. We can exploit this by learning how to optimise.

FastFlow’s Skeletons