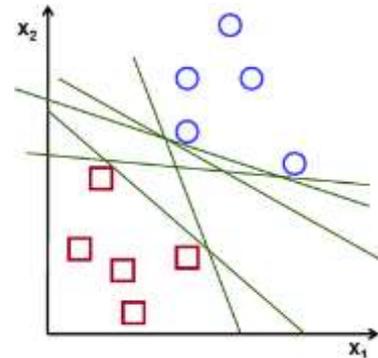


Machine Learning for Software Automatic Tuning

Computer systems often expose hundreds of configuration parameters that considerably influence their performance, and performance tuning is required in order to find a configuration that reaches high performance. Performance tuning activity is critical for software such as compilers.

Program automatic tuning (or **autotuning**) is an approach that relies on automated search and intelligent techniques to off-load the traditionally time-consuming manual tuning of applications. Autotuning makes possible the efficient exploration of the possible variants of an application, and provides some degree of portability, since autotuners can easily be re-run on different target architectures. An interesting approach for autotuning consists in moving the computational effort required by autotuners to a pre-processing phase to build a knowledge-based model, which can be later exploited to reduce the compilation time. This is done by using supervised **machine learning** (ML) methods.



1 MACHINE LEARNING WITH
SUPPORT VECTOR MACHINES

Goals

This thesis topic has the objective of designing and implementing novel software tuning approaches based on ML. The application scenario includes high-level application as well as compiler-based autotuning, and will focus on different aspects of ML modeling.

Available theses

Many theses are available, which are aimed at consistently improving the state-of-the-art of tuning methodology on one or more of the following aspects:

- New application of ML for software tuning (typically, a compiler optimization)
- New ways to encode information, e.g., from source code, to enhance ML modeling
- New ways to model known tuning problems
- New code synthesis approaches to generate training data for ML

As this is an active research area in our group, the theses are frequently updated. Details are available on request.

Desired Skills

- C programming
- Compiler Course
- Knowledge of machine learning or statistical modeling is a plus.

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References

- Classification https://en.wikipedia.org/wiki/Statistical_classification
- SVM https://en.wikipedia.org/wiki/Support_vector_machine
- Our paper (ordinal regression) <http://www.biagiocosenza.com/papers/CosenzaIPDPS17.pdf>