OUR Project Novel Solvers for Sparse Generalized Linear Models

Spring 2025 Project Proposal

Project Title

Benchmarking Novel Efficient Solvers for Sparse Generalized Linear Models

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Novel Solvers for Sparse Generalized Linear Models

Project Description

High-dimensional, sparse generalized linear models are widely used in statistics and machine learning. However, optimizing and fitting these models to data poses significant computational and algorithmic challenges for respective optimization algorithms. The framework of iteratively reweighted least squares (IRLS) (Daubechies et al. 2010, https://doi.org/10.1002/cpa.20303; Peng et al. 2022 https://proceedings.neurips.cc/paper_files/paper/2022/file/ba3354bcfeae4f166a8bfe75443ac8f7-Paper-Conference.pdf) has been shown to be highly effective and efficient for several sparse regression models, but has been under-explored in the context of sparse *logistic* regression, which is the backbone of many classification models in machine learning. In this project, we will develop a variant of IRLS that is specifically tailored for sparse logistic regression and benchmark it against other state-of-the-art methods within the benchopt" benchmarking framework [Moreau et al. 2021] and evaluate it on relevant datasets. If successful, this project will lead to a journal or conference publication.

Number of Openings

Requirements

Students with a good grasp of calculus and linear algebra are best suited for this project. Coding skills in Python will be required.

Preferences

Familiarity with regression models, in particular involving sparse modeling, is a plus.

Training

No specific requirements, training takes places during the research project meetings and in discussions with the faculty and graduate student mentor.

Anticipated Student Learning Outcomes

- Familiarization with some of the most widely used machine learning models
- Acquiring competence in structured, continuous optimization
- Establishment of basic knowledge relevant for understanding the state-of-the-art in efficient deep learning models
- Contribution to a top-tier research publication

Mentoring Plan

The student will be guided through the research process in weekly meetings with the mentoring faculty as well as in communication with a Ph.D. student, who serves as a co-mentor. Communication will occur additionally asynchronously through a Slack channel, during which smaller questions can be addressed. If the research project turns out to be successful, mentoring in academic writing and the preparation of research manuscripts will be provided.

Conflicts

Availability on Wednesdays or Thursdays for weekly project meetings with faculty and Ph.D. student mentor.