

Week 3 tasks

June 30, 2021

1. Implement the Gradientless descent algorithm (GLD) as a class, like you did for STP.
2. Compare the performance of GLD vs. STP on our two benchmark functions. As both are stochastic algorithms, we'll need to average over multiple independent trials. When visualizing the results (*i.e.* function values vs. number of oracle queries) we want to plot both the mean and the standard deviation. This stackoverflow question: <https://stackoverflow.com/questions/51680298/plot-mean-and-standard-deviation-as-a-s-noredirect=1&lq=1> (and links therein) should explain how to do this.
3. Have a look at the file `old_algorithms.py`. There is an implementation of the algorithm SignOPT (see Algorithm 1 in [CSC⁺19]). It is in quite a different format though, so I'd like you to rewrite it as a class, as we've done for all our other algorithms. There is also an implementation of GLD in this file that I'd forgotten about. You may want to have a look at this too. Finally, there is an implementation of the SCOBO algorithm [CMYZ20] in `old_algorithms.py`. Eventually we will want to implement this in our format, but this may be a task for another week.
4. Continue to look through the literature for zeroth-order algorithms that could be made into comparison-based algorithms.
5. (*Longer-term*) There are a few recent papers explicitly dealing with comparison-based optimization. For example [?]. We should definitely

look into these.

6. (*Longer-term*) Crucial to this project will be developing a representative library of test functions. I think the best existing library for zeroth-order optimization is here: <https://github.com/numbbo/coco> but I have always found it tricky to use. Also, we will need to wrap all of these function within our Comparison Oracle function.

References

- [CMYZ20] HanQin Cai, Daniel Mckenzie, Wotao Yin, and Zhenliang Zhang. Scobo: Sparsity-aware comparison oracle based optimization. *arXiv preprint arXiv:2010.02479*, 2020.
- [CSC⁺19] Minhao Cheng, Simranjit Singh, Patrick H Chen, Pin-Yu Chen, Sijia Liu, and Cho-Jui Hsieh. Sign-opt: A query-efficient hard-label adversarial attack. In *International Conference on Learning Representations*, 2019.