

Interactive comment on “Identification of hydrological model parameters for flood forecasting using data depth measures” by T. Krauß and J. Cullmann

Anonymous Referee #2

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This manuscript presents a modified version, "ARPE", of a data-depth sampling method, "ROPE". Three modifications are introduced: 1) A strategy, "GanDeep", is introduced to overcome the difficulty that generally parameters of hydrological models are not geometrically well-structured; 2) A Gaussian mixture model (GMM) is adopted to replace the uniform sampling in order to handle the high dimensionality; and 3) A well-founded stopping criterion in supervised machine learning is applied to prevent overfitting.

However, the designed experiments do not fully substantiate the effectiveness of the

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three modifications, due to the following facts:

1. The benchmark functions/model are too simple. In order to demonstrate the significance of the improvement by GanDeep, a benchmark function with highly irregular response surface is necessary. Recently, many sophisticated benchmark functions have been reported in machine learning literature.
2. The experiment are only conducted in very low-dimensional settings. However, as pointed by the authors, the real difficulty of depth based sampling is dealing with high-dimensional parameter spaces. In fact, modifications 1 and 2 are introduced to handle high dimensionality. Therefore, experiments on high-dimensional ($\geq 10D$) functions/models are indispensable.
3. Modification 3 is trivial. The control set is actually a validation set. The main point here is how to deal with very limited data and how design a sophisticated scheme of dividing data to calibration/validation, which is not part of design an optimization algorithm.

Some minor suggestions:

1. Depth based sampling is designed to subset the robust parameter vectors, but does not prove to be an effective and efficient optimization tool. Therefore, just modifying ROPE is not significant enough. I am glad to see that the author intends to merge depth based sampling with good search strategies.
2. It is not sufficient to make a general conclusion just based on a few number of case studies. The most preferable practice is to demonstrate that the improvement of parameter identification leads to an improvement of physical representation in the model.
3. The mathematical definition of the volume of unit sphere and unit cube should be provided as well as the formula of calculating the volume.
4. There are quite a few typos.