WIND ENERGY SCIENCE DISCUSSIONS

Open Access

eawe
european academy of wind energy

Interactive comment on "Cartographing dynamic stall with machine learning" *by* Matthew Lennie et al.

Tuhfe Gocmen (Referee)

tuhf@dtu.dk

Received and published: 6 September 2019

Dear Matthew and co-authors,

Your work focuses on bringing the accelerated developments in data analytics to the investigation of the dynamic stall behavior. Hence, it is an extremely interesting and innovative study, also very-well written. Although the turbine aerodynamics is not my major field as you might know, the article was easy to follow and the reader is guided with interesting questions raised occasionally. Having said that, this particular review of the article will focus almost exclusively on the deep learning methodology presented and implemented, as well as the overall structure of the manuscript.

Printer-friendly version

Discussion paper

Section 2 - Experimental Data:

- The online database for the wind tunnel dataset is nicely referred in the text. However, the reader should be able to tell which channels/signals from the dataset and at which resolution are considered in the training and validation of the neural network, without having to download the .zip files. Additional comments on the clarity of input data and pre-processing will follow in the corresponding sections of the article.

Section 3 - Machine Learning Approaches:
- The implementation of DTW is super interesting, and the brief description is nicely supported with Figures 3, 5 and 6. Note that the font size for Figures 5 and 6 are too big, and they can probably be merged into one Figure only.
- Figure 4 is a nice flowchart describing the methodology for clustering. Several comments about that:
1) The font is again too big,
2) It is better placed later in the article in my opinion, when all the pieces come together (now we see it before we read anything about dendograms for example)
3) The very first item on this flowchart can be extended to show the exact input variables, including the look-up tables, if any. It is rather unclear what exactly is fed into the clustering algorithm. It can also be a small table to support the flowchart, if Figure ends up being too crowded...
- In terms of pre-processing the input data, you have indicated the use of down-sampling and filtering. It would be nice to see a discussion on the time scales those processes might be affecting in your dynamic problem.

Section 4 - Results:
- As indicated in the previous review, Section 4.1 is still the methodology and it should probably be a part of Section 3.

- No need to say, it is simply exciting to see transfer learning through CNN applied to turbine aerodynamics. It would be nice to see the final architecture of the network though, including the frozen layers, and the number of parameters to train in two newly added layers. You can probably replace Figure 10 (which is generic) with that (which is specific to your problem).
- You have my sympathies for manual clicking on 733 images... How to quantify the uncertainties in the input then? :)
- The arguments regarding over-fitting problem are surely valid, can also be supported by presenting of data / of parameters to fit ratio (somewhat more quantifiable).
- Would you elaborate on the post-processing of the model results a bit more (on Page 9, Lines 85-95), especially since there is a significant reduction in the variance? Would be nice to see 'before-after', where the original distributions of the model output is presented together with the 'corrected' distributions.

Section 6 - Conclusions:
- Maybe the 'possible deep learning applications' part should be rephrased, can be tricky to find unsteady low-cost models for many wind energy applications, as Reviewer 1 also mentioned. Why not further train the generated model of this study? You can also maybe discuss how/if your network can be expanded by introducing data of a 'different texture', e.g. images vs. numeric time series, different resolutions, etc.

General Comments
- Most of the issues regarding Figures are addressed by Reviewer 1. One additional might be the legend placement on Figure 18 (the blockage effect...)
- There are typos but very few, here are the ones I managed to catch:
1) Page 4, Line 95 'blowing..' –> 'blowing.'
2) Page 4, Line 98 '/data-resource .' –> '/data-resource.'
3) Page 10, Line 14 'too' –> 'two'
4) Page 11, Line 20 'the' –> 'then'

5) Page 12, Line 72 'Dominin et al.' –> 2019 missing?
6) Page 15, Line 55 (TODO) ??? :)
Don't just take my word on it though, have another round of read.

Thank you for your super interesting work, looking forward to the updates!
Many greetings

Interactive comment on Wind Energ. Sci. Discuss., https://doi.org/10.5194/wes-2019-36, 2019.