Project Group:
Machine Learning for Predictive Maintenance
(Weekly Status Report)

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Calendar Week: 07 19 February, 2021

Completed Tasks

1. Submission of the final Study Report.
2. Took minutes of meeting

Tasks in-progress

1. Working on the milestone 3.
2. Working with team on first version of general sequence diagram.
3. Working with team on the first version of interface, class, and method definition.

Calendar Week: 06 12 February, 2021

Completed Tasks

1. Made changes based on the 1st Review, Approaches proper name, increase the sharpness of the image used, line alignment, removing extra space which make the text weird.

2. Understanding and implementing chapter tags.

Tasks in-progress

1. Give Review on Chapter HSC.

   (a) Introduction, motivation, contents like approaches, real data, evaluation, implementation.

Calendar Week: 05 05 February, 2021

Completed Tasks

1. Minor changes HIE chapter.
2. Restructuring the HIE chapter.
3. Changing the resolution of the images.

Tasks in-progress

1. Making necessary chances based on feedbacks (Christopher and Anurose).

Calendar Week: 04 29 January, 2021

Completed Tasks

1. Writing a feedback for common section like Introduction, document structure, abstract, motivation and formal definition for survey paper PdM4ML.

Tasks in-progress

1. providing a feedback for RUL chapter.

Calendar Week: 03 22 January, 2021

Completed Tasks

1. Making basic correction and adjustment for HI chapter.
2. Select a good resolution images for subsection topic in HI.
3. Analysing the use of proper references.

Tasks in-progress

1. Defining the third approach.
2. Working on conclusion for whole survey papers.
3. Making basic dhanges if necessary.

Calendar Week: 02 15 January, 2021

Completed Tasks

1. Updated GRNN approach data processing technique for HI chapter.
2. Worked on another approach which is HI prognostics approach for RUL for our HI chapter.
3. Discussed on conclusion structure for our survey paper with team.

Tasks in-progress

1. Working on Third approach HI based prognostics for ML.
2. Working on conclusion for our survey paper with teams.
3. Motivation of our chapter HI.

Calendar Week: 01 08 January, 2021

Completed Tasks

1. Working on GRRN Approach for HI chapter.

Tasks in-progress

1. Working on Motivation and introduction of the chapter HI Estimation.

Calendar Week: 52-53 30 December, 2020

Completed Tasks

1. Working on the structure for Topic HI Estimation.
2. The formal definition for HI.

Challenges

1. Working on the notation is/was a great headache.

Tasks in-progress

1. Working on GRNN approaches for Health Index(reference from seed paper [1])

References

[1] Islam, Md.Mominul, "Calculating a health index for power transformers using a subsystem-based GRNN approach", *IEEE Transactions on Power Delivery 33.4*, (2017): 1903-1912. https://ieeexplore.ieee.org/document/8097036

Calendar Week: 51 18 December, 2020

Completed Tasks

1. Create the entire work plan for milestone 2.
2. Working and understanding the time series.

Tasks in-progress

1. Working on the formal definition for our topic "Heath Index Estimation".
2. Look for the different approaches and methods for estimating the health index.

Calendar Week: 50 11 December, 2020

Completed Tasks

1. Deciding on the basic/common introduction section of a combined survey paper(Teamwork).
2. Possible Basic notation that can be used throughout the writing of a survey paper.

Challenges

1. Finding possible notations and working with the introduced notation by others(Team members).
2. Implementation of pipeline elements.

Tasks in-progress

1. Searching for different methods which we are going to introduce for our topic "Health index estimation".
2. Working on the implementation of the pipeline element.
3. Estimation of the work plan for the coming weeks.
4. Working on subsection "Motivation and formal definition".

Calendar Week: 49 04 December, 2020

Completed Tasks

1. Work with the team to develop adaptive templates and structures for documents.
2. Also, the structure for Git for Milestone 2.
3. Planning the structure of our topic "Health Index Estimation".

Challenges

1. Lots of ideas, confusion in structuring the subject areas.
2. Some questions about unclear sections like "What does the evaluation setup mean?"

Tasks in-progress

1. Working on writing a survey on the topic "Health Index Estimation"
2. Working on the facts needed, knowledge extraction from specific survey papers [1][2][3], and seed literature [4] [5] for Milestone 2.

References

[1] Y. Ran, X. Zhou, P. Lin, Y. Wen, and R. Deng, "A survey of predictive maintenance: Systems, purposes and approaches", *arXiv preprint arXiv:1912.07383*, 2019, https://arxiv.org/pdf/1912.07383.pdf.

[2] W. Zhang and D. Yang and H. Wang, "Data-Driven Methods for Predictive Maintenance of Industrial Equipment: A Survey", *IEEE Systems Journal*, vol. 13, no. 3, pp. 2213-2227, 2019, https://ieeexplore.ieee.org/document/8707108.

[3] T. P. Carvalho and F. Soares and R. Vita and R. Francisco and João P. Basto and Symone G.S. Alcalá, "A systematic literature review of machine learning methods applied to predictive maintenance", *Computers & Industrial Engineering*, vol. 137, p. 106024, 2019.

[4] Islam, Md.Mominul, "Calculating a health index for power transformers using a subsystem-based GRNN approach", *IEEE Transactions on Power Delivery 33.4*, (2017): 1903-1912. https://ieeexplore.ieee.org/document/8097036

[5] Malhotra, Pankaj, "Multi-sensor prognostics using an unsupervised health index based on LSTM encoder-decoder.", *arXiv preprint arXiv:1608.06154*, (2016). https://arxiv.org/pdf/1608.06154.pdf

Calendar Week: 48 27 November, 2020

Completed Tasks

1. Finished reading with survey paper 3 [1]. This paper aims to provide a systematic literature review covering the major published solutions for PdM techniques based on ML methods.

    - Section 3 represents the main steps of the development of an ML model.
    - Section 4 shows some research-based questions on PdM techniques.
    - Section 5 gives some insight into data sets that can be used for future research by PdM applications.

References

[1] T. P. Carvalho and F. Soares and R. Vita and R. Francisco and João P. Basto and Symone G.S. Alcalá, "A systematic literature review of machine learning methods applied to predictive maintenance", *Computers & Industrial Engineering*, vol. 137, p. 106024, 2019.

Calendar Week: 47 20 November, 2020

Completed Tasks

1. Set up the Git-Lab environment on my desktop for easy and convenient overflow in the future.

2. Finished reading with the survey paper 2 [1]. The general ideas and contributions are as follows:

   - General focus was on data-driven methods for PdM.
   - Review based on a period of five years for industrial applications of PdM from the perspective of DL and ML.

Tasks in-progress

1. Working on survey paper 3 [2]. The general ideas and focus of this paper is based on:

   - Scientific database which provides a useful Foundation for ML techniques. Which also support new research work in the PdM field

References

[1] W. Zhang and D. Yang and H. Wang, "Data-Driven Methods for Predictive Maintenance of Industrial Equipment: A Survey", *IEEE Systems Journal*, vol. 13, no. 3, pp. 2213-2227, 2019, https://ieeexplore.ieee.org/document/8707108.

[2] T. P. Carvalho and F. Soares and R. Vita and R. Francisco and João P. Basto and Symone G.S. Alcalá, "A systematic literature review of machine learning methods applied to predictive maintenance", *Computers & Industrial Engineering*, vol. 137, p. 106024, 2019.

Calendar Week: 46 13 November, 2020

Completed Tasks

1. Finished reading with the survey paper [1]. The general ideas and contribution of this paper are as follows:
    - PdM system architectures, purposes, and approaches.
    - A high-level view of the PdM system architectures which, includes OSA-CBM), cloud-enhanced PdM system, and PdM 4.0

Challenges

1. Understanding through the few topics presented in the survey paper [1] was a bit difficult. Real challenges started when Mathematical term/calculation started like for (Cost minimization, run time, reliability, and so on)

Tasks in-progress

1. Working on the survey paper 2 (Data-Driven Methods for Predictive Maintenance of Industrial Equipment)[2]. The main focus of the paper is based on:
    - PdM scheme for particular appliances, challenges encounter, approaches.
    - Based on six algorithms of ML and DL(deep learning) tries to classify the industrial applications.

References

[1] Y. Ran, X. Zhou, P. Lin, Y. Wen, and R. Deng, "A survey of predictive maintenance: Systems, purposes and approaches", *arXiv preprint arXiv:1912.07383*, 2019, https://arxiv.org/pdf/1912.07383.pdf.

[2] W. Zhang and D. Yang and H. Wang, "Data-Driven Methods for Predictive Maintenance of Industrial Equipment: A Survey", *IEEE Systems Journal*, vol. 13, no. 3, pp. 2213-2227, 2019, https://ieeexplore.ieee.org/document/8707108.

Calendar Week: 45 06 November, 2020

Completed Tasks

1. Reading through the material provided for this week on panda for ML4PdM is completed.

2. Working with the team to come up with an idea of "how to structure the "Templates for Minutes and Weekly Reports" report.

Challenges

1. Coming up with the ideal structure for Templates.

2. Organizing time for Project sessions and working along with the team.

Tasks in-progress

1. Reading through the survey paper 1 (A Survey of Predictive Maintenance: Systems, Purposes, and Approaches.) [1]. General idea of this paper:

    - PdM is a maintenance paradigm that performs maintenances after the analytical models predict sudden failures or degradations.

References

[1] Y. Ran, X. Zhou, P. Lin, Y. Wen, and R. Deng, "A survey of predictive maintenance: Systems, purposes and approaches", *arXiv preprint arXiv:1912.07383*, 2019, https://arxiv.org/pdf/1912.07383.pdf.