Assignment 12.1 Research for Deep Learning with Time Series Data

CPE32S3 - CPE 019

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PAPER REVIEW ESSAY

I found a significant research endeavor that was **authored by Indrasiri et. al.** This **research was presented at the 2023 45th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) in Sydney, Australia (2023)**. This research **focuses on the potential of using Deep Learning (DL) and the Internet of Health Things (IoHT) to detect disorders that focus on patients in later disease stages which I do think is useful in the field of healthcare.** It highlights the value of time series data but notes a lack of effective DL architectures for classification with limited data, especially in healthcare for rare diseases. The **research objective is developing a DL architecture capable of handling limited clinical time series data to construct robust models and make accurate predictions**. This could help in addressing the gap by investigating the accuracy of predictions using an Ensemble DL architecture, **comprising a deep CNN model** and transfer learning methods like ResNet and MobileNet. Regarding their **methodology, what they do is they train the model on 3D images generated from time series data using transformation techniques** like Recurrence Plot, Gramian Angular Field, and Fuzzy Recurrence Plot. **As a result**, it gave promising classification accuracy, even with limited datasets, surpassing other state-of-the-art methods tested on the ECG5000 dataset. **Based on my conclusion regarding their research study,** their research paper indeed highlights a new ensemble deep learning model called ENSE-CNN-LSTM that is specifically designed for classifying limited time series data in the Internet of Healthcare Things (IoHT) which satisfies the objective they state. I also recognized that the use of sliding time windows and more efficient image generation techniques could improve the model's performance on limited datasets.

I found a noteworthy research endeavor that was **authored by Adiba et. al.** and **presented at 2021 International Conference on Innovative Trends in Information Technology (ICITIIT) in Kottayam, India (2021)**. Their research **focuses on utilizing deep learning methods to predict multiple features in a pediatric cardiac intensive care unit (ICU) setting, where patients are in critical condition**. This could be

beneficial to ICU settings since they are always dealing with criticality and they must not waste any time. Their dataset consists of 8957 rows and 5 columns that was split into training (80%) and testing (20%) sets for time series prediction. The features predicted are PO2 and HCO3. For training, 7165 data points are used, while 1791 data points are reserved for testing. Their **research objective is to assist doctors in decision-making by providing accurate predictions based on hourly collected time-series data.** With regards to their methodology, **what they do is implement Recurrent Neural Network and Long Short-Term Memory for multivariate time series prediction**. Comparative analysis between RNN and LSTM models is conducted, and doctors' feedback is incorporated to validate the results. **As a result,** LSTM consistently outperforms simple RNN across both 80%-20% and 90%-10% train-test splits. LSTM's superior performance suggests its efficacy in predicting patient data changes over time, aiding medication decisions. **Based on my review of this research,** both LSTM and simple RNN are quite effective when it comes to predicting multivariate time series data in pediatric ICU scenarios, even though it's a pretty complex task. I see that split does not matter, LSTM consistently outshone simple RNN. This really highlights LSTM's capability in accurately forecasting changes in patient data over time which could be invaluable when it comes to making critical medication decisions.

I found a remarkable research endeavor that was **authored by Iha et. al**. This **research was presented at the 36th International Technical Conference on Circuits/Systems, Computers and Communications (ITC-CSCC) in Jeju, Korea (South) (2021)**. This research **focuses on improved methods for predicting multivariate time series data in tourism resorts**. Their methodology utilizes supervised learning to amalgamate potential influencers such as weather conditions and consecutive holidays into single time-series data, termed as event impacts. This data was connected into an LSTM-based prediction model. Experimental findings using real data demonstrate the efficacy of the approach. Their **research objective to this paper is to enhance the forecasting accuracy of an LSTM-based multivariate time-series model to generate unified time-series data that captures the**

influences affecting tourism demands. As a result, the paper only suggests future directions, including the development of a new LSTM model tailored for multivariate time series and refining the learning algorithm to better capture event impact signals. **Based on my review of this research,** their approach successfully achieved the enhancement of the model they developed and with this being established, I do think that their model is effective in determining the research target or objective and focus based on the data that they have in their full paper. However, they suggested a model and technique to be used when dealing with this research topic or study, which means that this research can be improved more.

References:

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