HURAIM: MULTIVARIATE LONG SHORT-TERM MEMORY (LSTM) NETWORKS FOR REAL-TIME HURRICANE INTENSITY AND TRAJECTORY FORECASTING

A PREPRINT

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ABSTRACT

This paper will describe and show the development of an LSTM trained to predict hurricane kinematic (latitude and longitude movement) and barometric (pressure) measurements. The LSTM will be trained on a data pipeline of how the training and test data is ingested into an environment, converted to work with Python programming language with a TensorFlow and pandas data frame, creating inference, and outputting them for either a live hurricane or a test file. This will output four separate models: Multivariate (Primary Objective), Univariate Wind Model, Univariate Latitude Model, and the Univariate Longitude Model. These outputs for these models will be Predictions for Wind, Lat, and Long Multivariate 3 total for Univariate Output KML and CSV file for viewing purposes only. These disparate models will allow us to compare the accuracy of the Multivariate model inference (predictions) to that of the univariate models that current research is being done on. A simple regression averaging method called mean absolute error will be used for comparing the predictions of each output variable against the multivariate model. This paper will demonstrate how we implement, train, and evaluate the model for future research and use.

Keywords Hurricane · Tropical Storm · Machine Learning

1 Introduction

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*Use footnote for providing further information about author (webpage, alternative address)—*not* for acknowledging funding agencies.

2 Headings: first level

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2.1 Headings: second level

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$$\xi_{ij}(t) = P(x_t = i, x_{t+1} = j|y, v, w; \theta) = \frac{\alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})}{\sum_{i=1}^{N} \sum_{j=1}^{N} \alpha_i(t) a_{ij}^{w_t} \beta_j(t+1) b_j^{v_{t+1}}(y_{t+1})} \tag{1}$$

2.1.1 Headings: third level

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3 Examples of citations, figures, tables, references

3.1 Citations

Citations use `natbib`. The documentation may be found at

`http://mirrors.ctan.org/macros/latex/contrib/natbib/natnotes.pdf`

Here is an example usage of the two main commands (`citet` and `citep`): Some people thought a thing [Kour and Saabne, 2014a, Hadash et al., 2018] but other people thought something else [Kour and Saabne, 2014b]. Many people have speculated that if we knew exactly why Kour and Saabne [2014b] thought this...

3.2 Figures

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetuer odio sem sed wisi. See Figure 1. Here is how you add footnotes. [2] Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetuer eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.

[2] Sample of the first footnote.

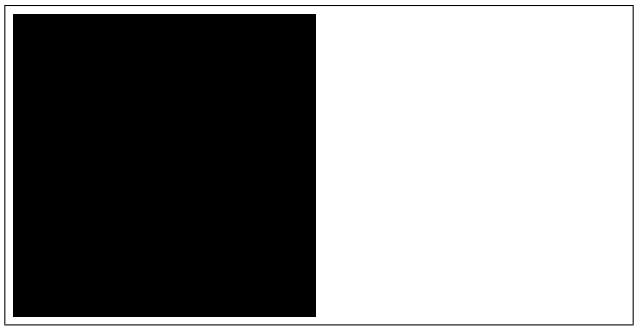

Figure 1: Sample figure caption.

Table 1: Sample table title

	Part	
Name	Description	Size (μm)
Dendrite	Input terminal	$\sim$100
Axon	Output terminal	$\sim$10
Soma	Cell body	up to 10^6

3.3 Tables

See awesome Table 1.

The documentation for `booktabs` ('Publication quality tables in LaTeX') is available from:

`https://www.ctan.org/pkg/booktabs`

3.4 Lists

- Lorem ipsum dolor sit amet
- consectetur adipiscing elit.
- Aliquam dignissim blandit est, in dictum tortor gravida eget. In ac rutrum magna.

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