MTH 5320 - Proposal **for Mini Project 1**

# Deep learning-based data-driven method for predicting hurricane intensity over North Atlantic Ocean regimes.

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**Objective**: Prediction of hurricane intensity (North Atlantic) based on computed atmospheric-ocean thermodynamic and dynamic quantities.

**Proposed methodology:** Methodology includes the application of a fully connected ANN model for hurricane intensity prediction (sustained wind speed) based on available historical hurricane track datasets and Global Atmospheric and Oceanic reanalysis datasets.

1. **Preprocessing**
2. Hurricane tracks for calculation of predicants are extracted using IBTRACKS dataset [1].
   1. Hurricane tracks are available for the period 1989-2022 (6 hourly)
3. Track based preprocessing of predicants.
   1. Most of the atmospheric and oceanic conditions are from ERA-5 reanalysis model products [2].
   2. Others significant indices are derived/calculated from the ERA-5 model.

Predictand variables under consideration: Sea Surface Temperature, Mid-Tropospheric humidity, Low level vorticity, Distance from the coast, Initial intensity change (12-hour wind speed difference)

1. **Computation of predicants**
2. Computation of predicant variables across the track. (Excluding land points)
3. The variables will be decided based on tests, availability, and significance. (Proposing minimum 4 computed features)

**Model development:** An ANN based fully connected model for predicting sustained wind speed (intensity) for every 6 hours. The targets should be sustained wind speeds at each 6-hour time step modelled based on the predictands discussed above.

**Model evaluation:** Model evaluation and tuning are based on:

1. Number of hidden layers
2. Feature selection and scaling
3. Hyperparameter selection

**Future scope**: Can be used for predicting hurricane intensity in real time, if numerical forecasts and forecast track is given.

**References:**

1. *Knapp, K. R., M. C. Kruk, D. H. Levinson, H. J. Diamond, and C. J. Neumann, 2010: The International Best Track Archive for Climate Stewardship (IBTrACS): Unifying tropical cyclone best track data.* Bulletin of the American Meteorological Society*, 91, 363-376.* [*doi:10.1175/2009BAMS2755.1*](https://doi.org/10.1175/2009BAMS2755.1)
2. *https://cds.climate.copernicus.eu/cdsapp#!/dataset/reanalysis-era5-land?tab=overview*