# Deepti: Deep Learning-based Tropical Cyclone Intensity Estimation

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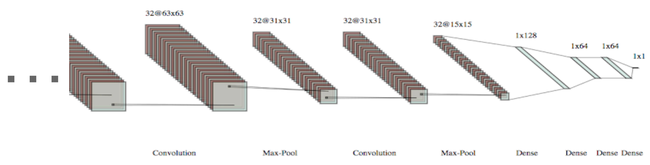
## Introduction

We present the development of a deep learning model for objective estimation of tropical cyclone intensity at a higher temporal frequency, deployment of the model in production, design and implementation of the tropical cyclone monitoring and intensity estimation system and development of an interactive portal for situational awareness and evaluation of intensity estimation.

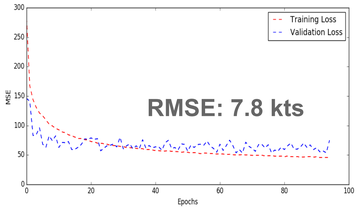
## Data

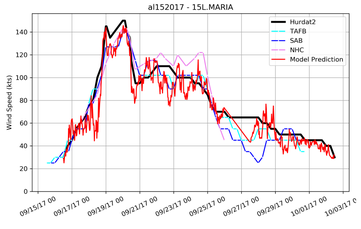
## Approach




*Custom Convolutional Neural Network*

## Results




**North Atlantic**

~Piñeros et al. (2011): 14.7*kt*

~Ritchie et al. (2012): 12.9*kt*

**North Pacific**

~Ritchie et al. (2014): 14.3*kt*

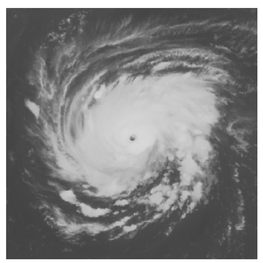
**We have a deep learning model!!! Now what?**

## Why doesn't model end up in production?

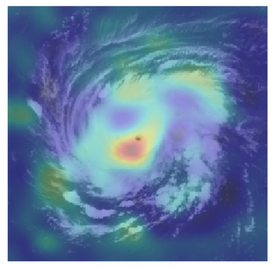
A. Trust factor: AI is a **black box**

B. Transforming Research AI model to Production is **difficult**

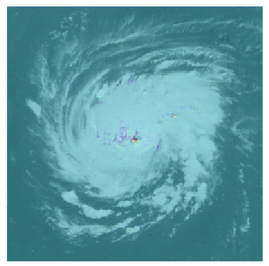
## Understanding how system makes decisions



Hurricane Florence



Class activation map



Feature saliency map

## Deploying Model in Production

A. Performance requirements

B. Back-testing

C. Now testing

D. Interpret prediction data - maybe just numbers

Questions:

- Does the model confidence remain same over time?
- How do you maintain?
- How do you include new training data?

## Coordinated effort

**ML Researchers**

A. Transform ideas into models

B. Training data

C. Monitor

**Domain Experts**

A. Evaluation

B. Performance baselines

C. Science use case

**End-user/Stakeholders**

A. Production requirements

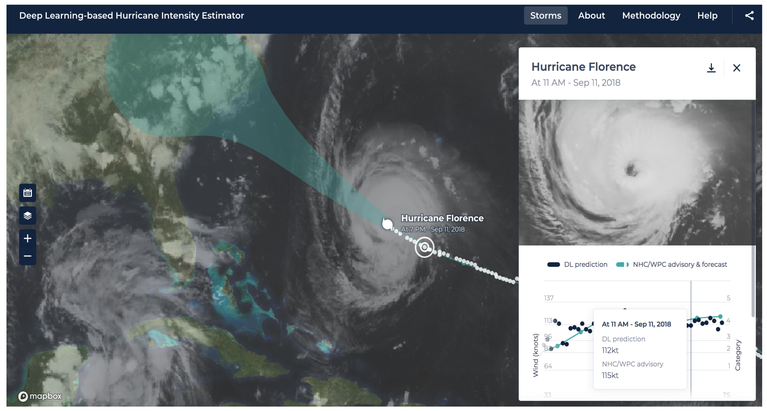
**ML/System developers**

A. Design

B. Quick prototype

C. Scale/Log

## Tropical Cyclone Intensity Estimation Portal




http://hurricane.dsig.net

## Features

A. Monitor NHC outlook for "invest" area for trigger

B. Near real-time tropical cyclone intensity estimation services

C. Map display

D. Relevant layers

E. Comparison with operational forecasts

F. Evaluation

G. Service APIs

## Challenges and Lessons Learned

A. Consistent large scale training data

B. AI black box

C. Training data/Input data becomes part of the code

D. Versioning training data, model, algorithm becomes difficult

E. DevOps, CI/CD – new meaning

F. Complexity with evolving platforms and infrastructure

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