

## Project Report

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# LEARNING CONTINUOUS-TIME PDEs USING MESSAGE PASSING GRAPH NEURAL NETWORK FOR COVID-19 CASES EVOLUTION DATA

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## ABSTRACT

This report presents results of few experiments to see whether the GNN-based model is able to learn the underlying PDE for COVID-19 spread data. Mostly, it's the other way that people propose the PDE (based on some physical processes/models) and try to estimate the parameters. But, This results shows that the GNN based model can learn similarly accurate model just from the data.

**CODE** at [https://github.com/abhayk1201/Project/tree/main/Covid\\_GNN\\_PDE](https://github.com/abhayk1201/Project/tree/main/Covid_GNN_PDE)

## 1 Details

**Training Data:** Daily covid cases from 1/22/20 (22 Jan) till 7/19/20 (19 July)

**Testing Data:** Daily covid cases from 1/22/20 (22 Jan) till 11/16/20 (16 Nov)

**Dataset (Johns Hopkins University):** <https://github.com/CSSEGISandData/COVID-19>

**Method Description Report:** [https://github.com/abhayk1201/Project/blob/main/1\\_PDE\\_GNN\\_project\\_report.pdf](https://github.com/abhayk1201/Project/blob/main/1_PDE_GNN_project_report.pdf)

**CODE, Data, & Model:** [https://github.com/abhayk1201/Project/tree/main/Covid\\_GNN\\_PDE](https://github.com/abhayk1201/Project/tree/main/Covid_GNN_PDE)

**Model Convergence:** I tried training with actual covid case count, actual latitude and longitude, the model fails to converge. But when I normalized these values in (0,1) range (using  $\frac{val-min}{max-min}$ ), then the model converged fine. (Most likely, it has to do with the way torchdiff modules)

## 2 Results

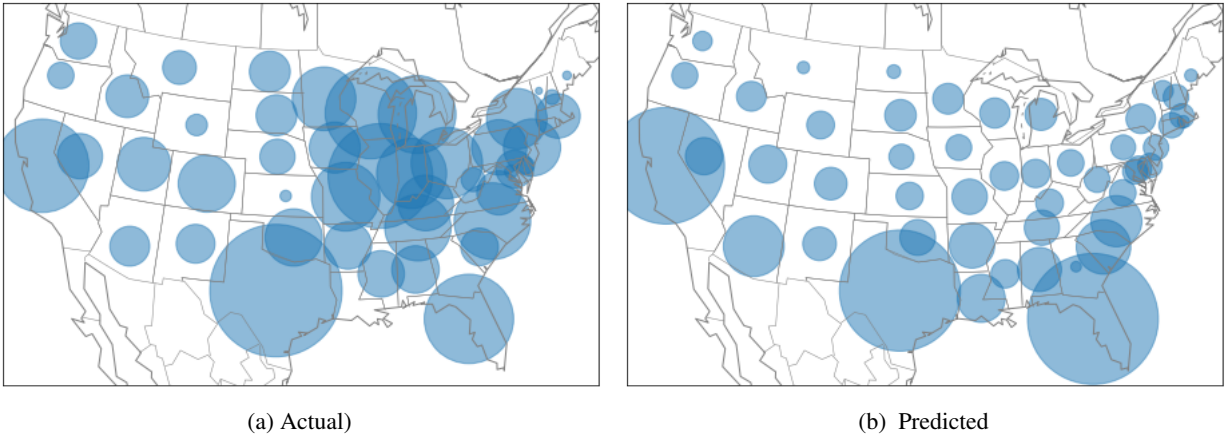


Figure 1: Comparison of state-wise Covid cases on **10/22/20**

## 3 Results

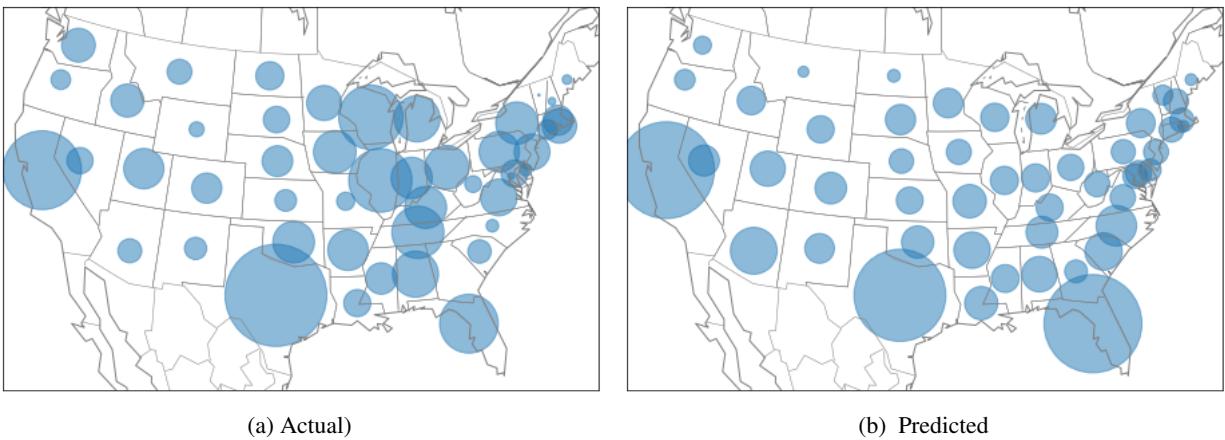


Figure 2: Comparison of state-wise Covid cases on **9/28/20**

## 4 Results

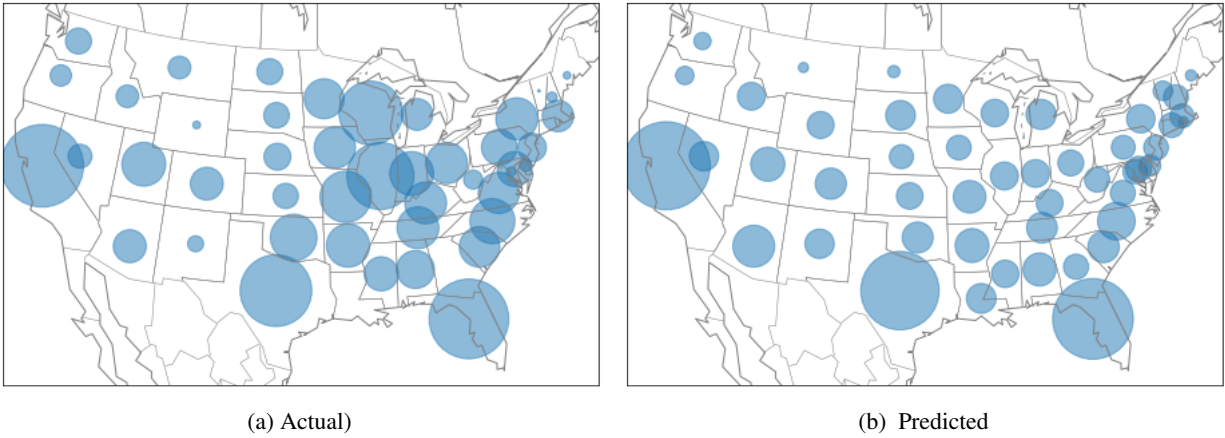


Figure 3: Comparison of state-wise Covid cases on **9/17/20**

## 5 Results

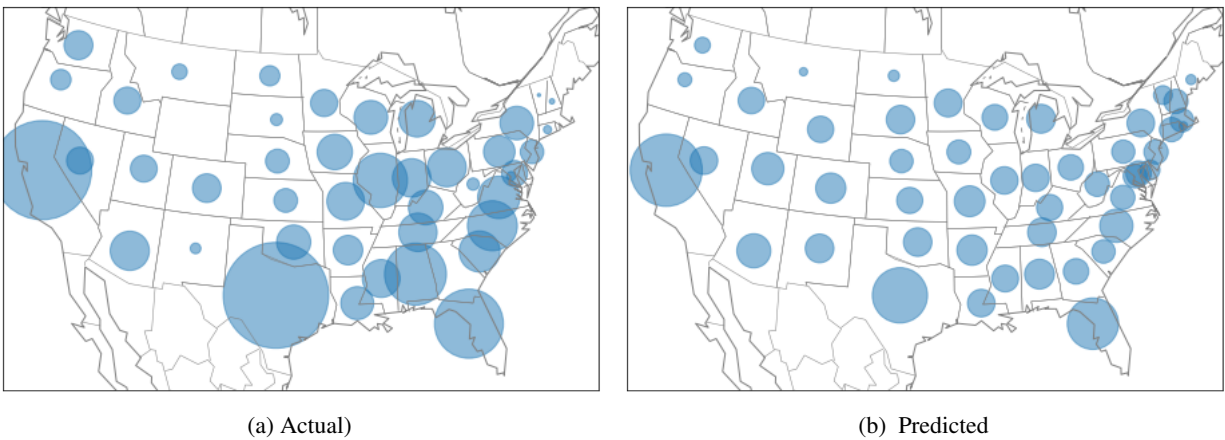


Figure 4: Comparison of state-wise Covid cases on **8/23/20**

## 6 Results

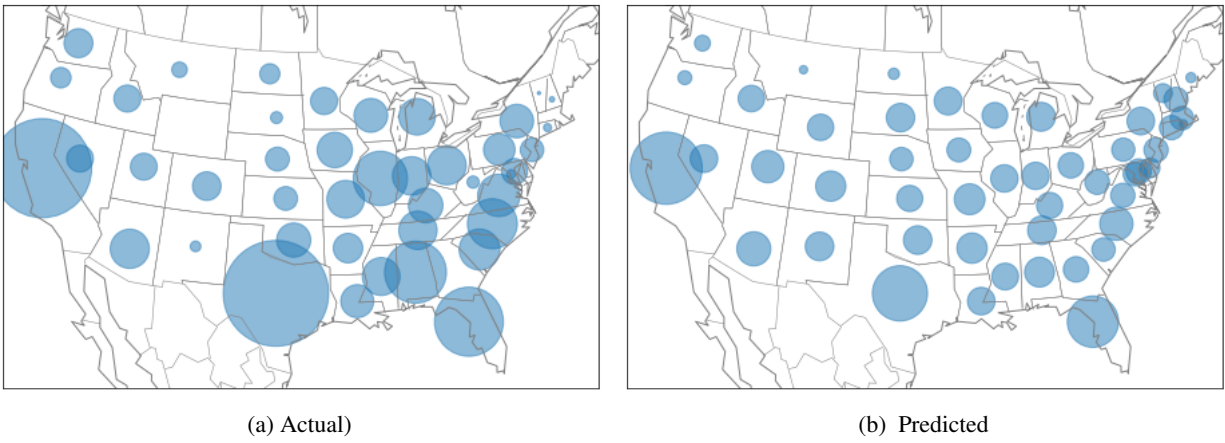


Figure 5: Comparison of state-wise Covid cases on **6/20/20**

## 7 Code

**CODE, Data, & Model:** [https://github.com/abhayk1201/Project/tree/main/Covid\\_GNN\\_PDE](https://github.com/abhayk1201/Project/tree/main/Covid_GNN_PDE)