

Spatial AI - Project proposal

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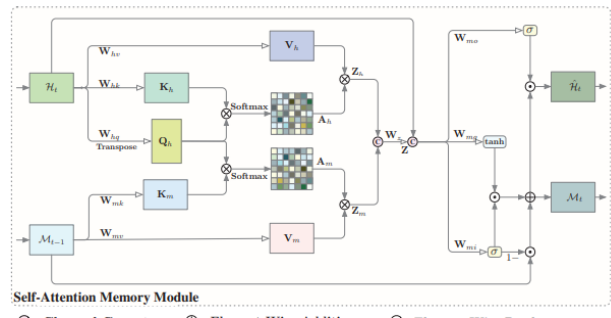
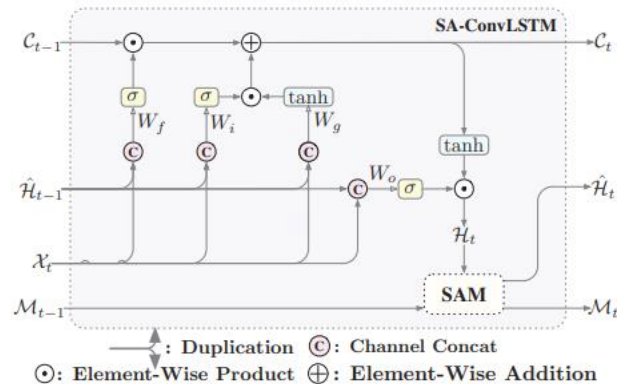
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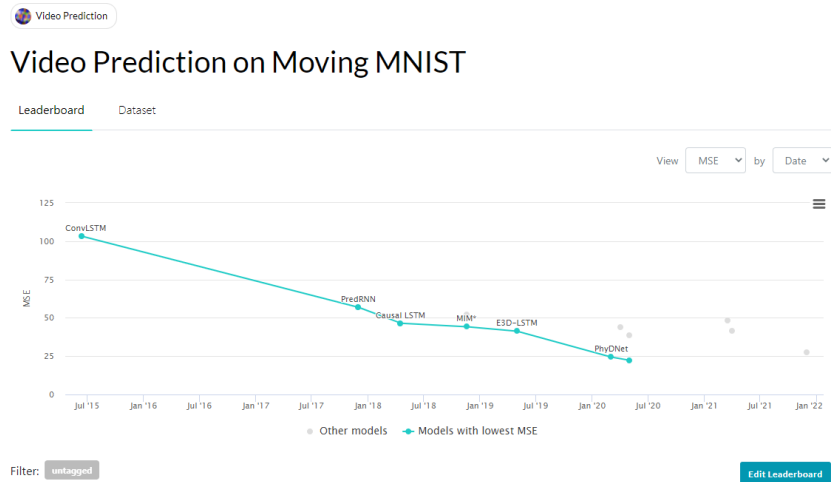
About this project

- This project is going to **build a time-series deep learning method** using common dataset, then apply to **satellite imagery dataset**.
- This project utilizes a SOTA baseline model:

3.3 Self-Attention ConvLSTM



A trend in Video Prediction & Limitation of current practice



- Mainly focus on applying their model into common dataset
- Mainly focus on an increase in similarity structure & a decrease in MSE
- Do not take into consideration **image detail** such as a trajectory of shape or motion in common dataset



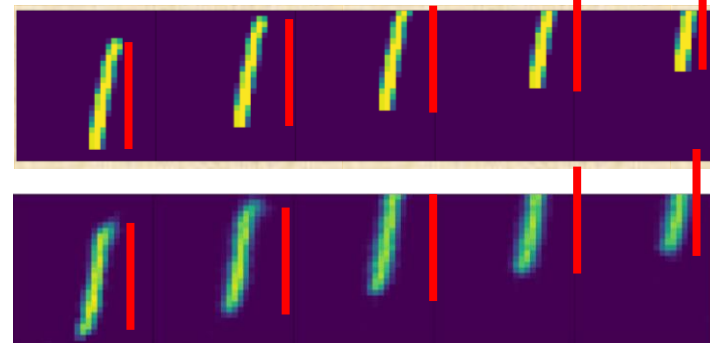
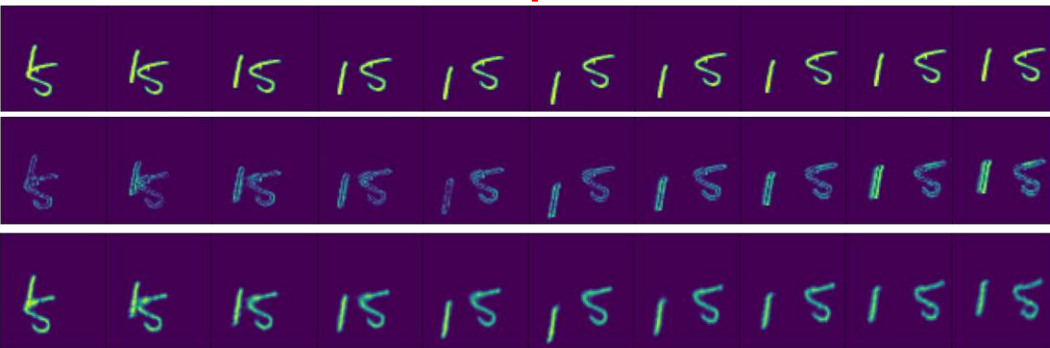
Challenge

Some hypothesis and analysis in improving the model to capture image detail

ID	Error Pattern (Hypothesis)	Test sample #
1	When a digit moves only in a small distance, the model cannot correctly forecast the digit's direction and pace.	2 7 11 14 17 18 19 21
2	When digits start merging, the model loses these digits' information.	4 5 6(maybe) 7 10 9 11 16
3	Error is kept until the end of the prediction window (Error propagation)	8 12 13 14 15 19 20
4	Really bad prediction (Neither capture digits nor movings)	9 16



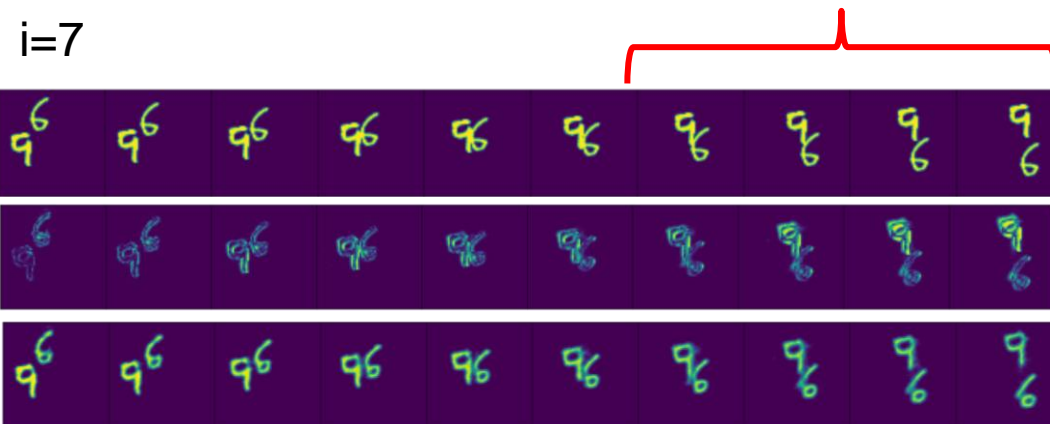
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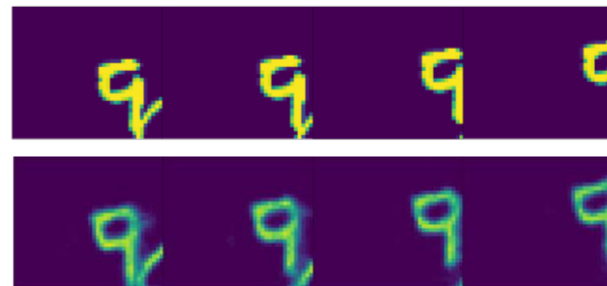
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SA-ConvLSTM

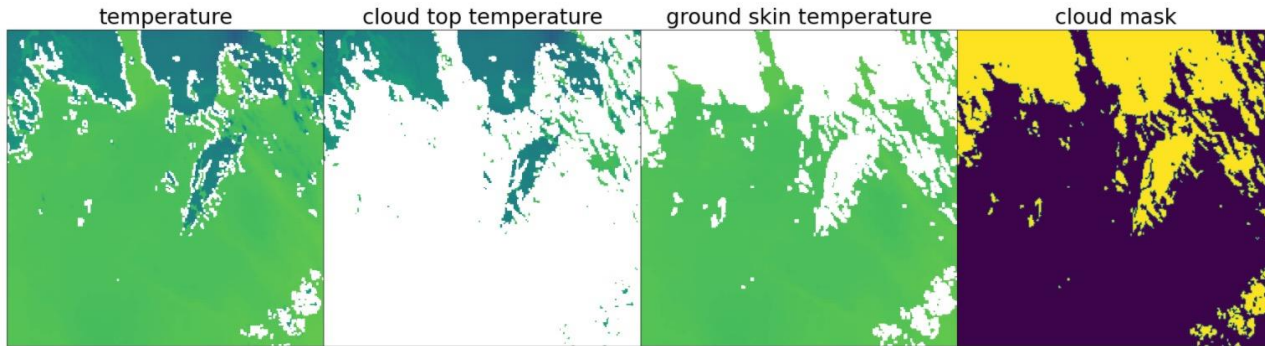
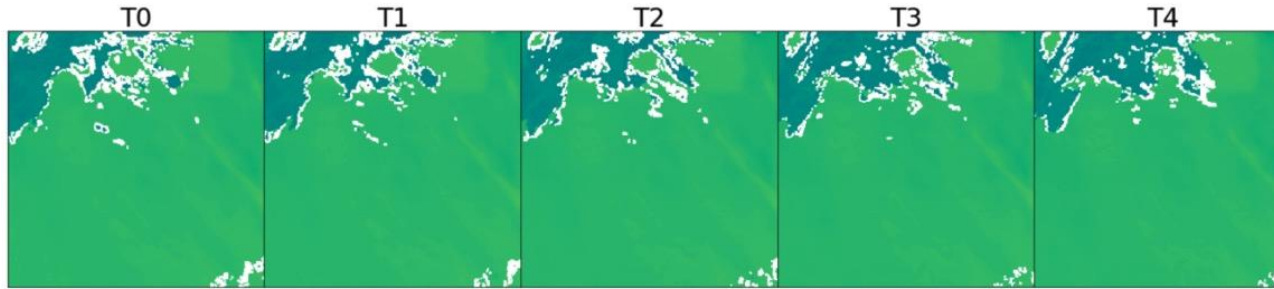
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[:35, :40]

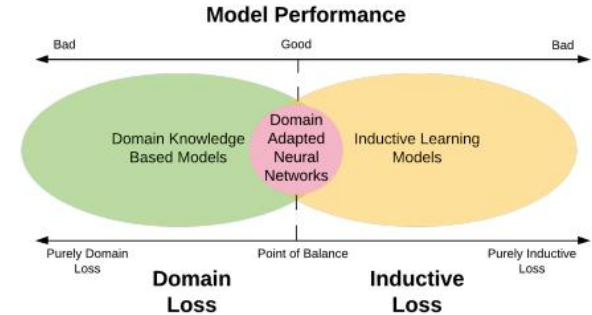


Satellite Imagery Data



Approach

- Incorporating prior domain knowledge [**Cloud Type**] into neural network model, motivated by Monotonicity constraints (Abu-Mostafa, Y, 1992)
- The efficiency of incorporating prior knowledge domain with NN has been proved (Muralidhar N et al, 2018)
- This projects aims to forecast next 4-time bin (1 bin: 15 minutes) by using previous 4-time bin.



Abu-Mostafa, Y. (1992). A method for learning from hints. *Advances in Neural Information Processing Systems*, 5.

Muralidhar, N., Islam, M. R., Marwah, M., Karpadne, A., & Ramakrishnan, N. (2018, December). Incorporating prior domain knowledge into deep neural networks. In *2018 IEEE international conference on big data (big data)* (pp. 36-45). IEEE.



The impact of the final project

- Contribute to applying theory-base DL **model to real world dataset**
- Helping national weather forecasting research with a better prediction in **detailed image**



Evaluation Metrics

- The project will be compared with **existing SOTA model** in video and satellite Imagery dataset
- Compare those base-line models with my suggested model using **Structural Similarity Index, Mean Squared Error, and Number of parameters**



Q & A

