ReSCAL (real-space cellular automaton laboratory) is a simulation software used to make geomorphic predictions of sand dunes using a simple cellular automata structure. These simulations require a vast amount of both computing time and memory. Here we train a GAN to make video predictions of the sand dune model at a certain time step, $T$.  

**SAND DUNE PREDICTIONS ARE COMPUTATIONALLY EXPENSIVE**

Each cell is treated as a “doublet”, or a nearest neighbor cell, within the cell space.

- A 50 x 200 x 80 3D space takes 20 minutes to generate the predicted model at $T_{500}$.  
- A 100 x 1800 x 200 3D space requires around 24 hours to generate the predicted model at $T_{500}$.  

$T_{500}$ is equivalent to the state of the model 13 days into the future.

**SIMULATING SAND DUNE DATA**

- Generate sand dune elevation values for a 3D model with dimensions 100 x 1800 x 200 until $T_{500}$  
- Split each frame into 32 x 32 crops for training  
- Train the GAN model to generate predictions of the next frame given the first four frames of the model

**VIDEO PREDICTION USING A GAN**

Generative Adversarial Networks

- Generator learns to create accurate predictions of the next frame given the past four frames  
- Discriminator, or the “adversary”, learns to differentiate between “real” and “fake” frames  
- The generator makes more accurate predictions of the next frame, attempting to “fool” the discriminator

**PREDICTED FRAME $F_5$**

- $F_1$, $F_2$, $F_3$, $F_4$, $F_{gt}$, $F_{gen}$

**DISCUSSION/FUTURE WORK**

- High level of abstraction when we treat this as a video prediction problem – we only train the model on the output at each time step  
- Due to the inherent stochastic behavior of these sand dune models, the predictions will never be 100% accurate  
- Compare the results for training the adversarial network and the non-adversarial network  
- Train the model using images that contain a longer period of time in between each one in order to capture and predict more movement

**REFERENCES**


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Objective: Train a GAN to make accurate predictions of the sand dune model at $F_5$. 

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