Wildfire project

Applying Data Science

Deadlines:

Code: Friday, 26th May 2023 at **12:00** BST

Presentation: Friday, 26th May 2023 at **17:00** BST

WILDFIRE PROJECT

- Available data (links in the next slide):
  - `Ferguson_fire_train`
  - `Ferguson_fire_test`
  - `Ferguson_fire_background`
  - `Ferguson_fire_obs`

Ferguson wildfire (2018), Source: Google

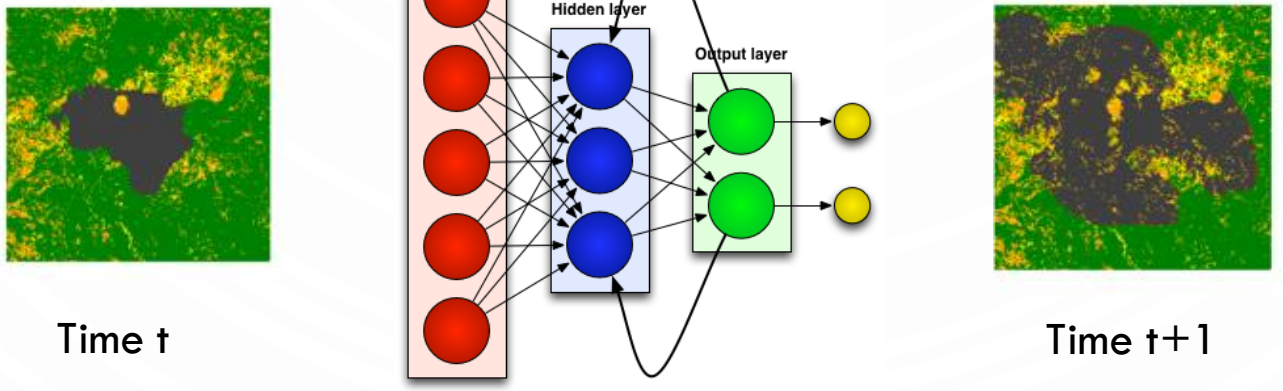
- Using this data, address 3 objectives described in the next slides.
- SUBMIT **3 SEPARATE NOTEBOOKS –** one per objective

DATA

- Model data (already pre-processed):
  - `Ferguson_fire_train.zip`: training data obtained from wildfires simulations
  - `Ferguson_fire_test.zip`: similar to `Ferguson_fire_train` but obtained from different simulations
  - `Ferguson_fire_background.zip`: model data for the data assimilation
- Satellite data (already pre-processed):
  - `Ferguson_fire_obs.npy`: Observation data at different days after the ignition (only one trajectory)

OBJECTIVE 1

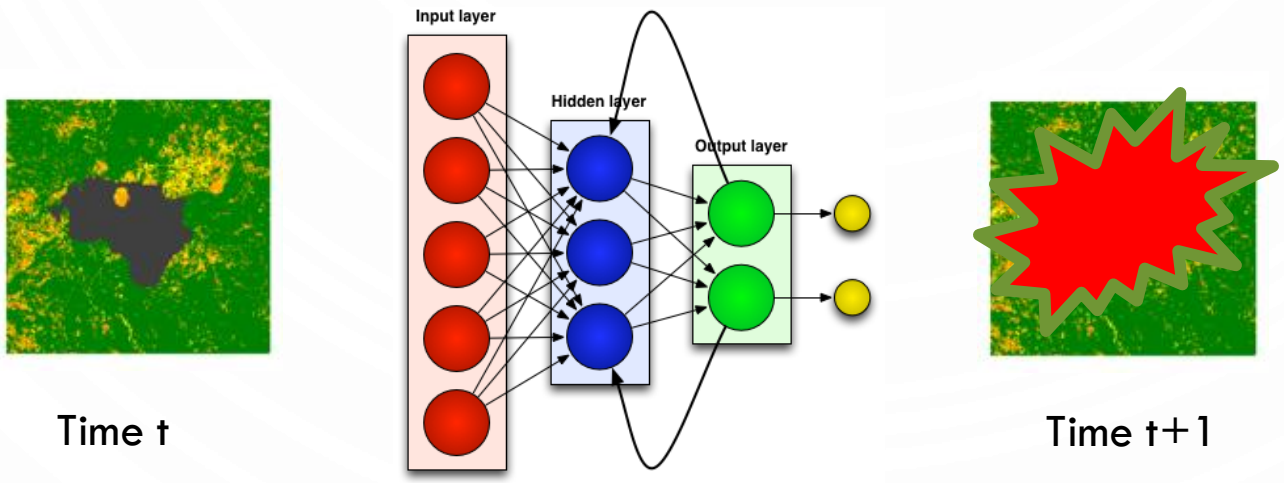
- **Build a SURROGATE MODEL using RNN** - Use a recurrent neural network to train a surrogate model of a wildfires predictive model.
  - **Step 1**: Use the model data for training (`Ferguson_fire_train`) and test the model using the model data for testing (`Ferguson_fire_test`).



Note: you can use any recurrent neural network. LSTM could be a good option.

OBJECTIVE 1

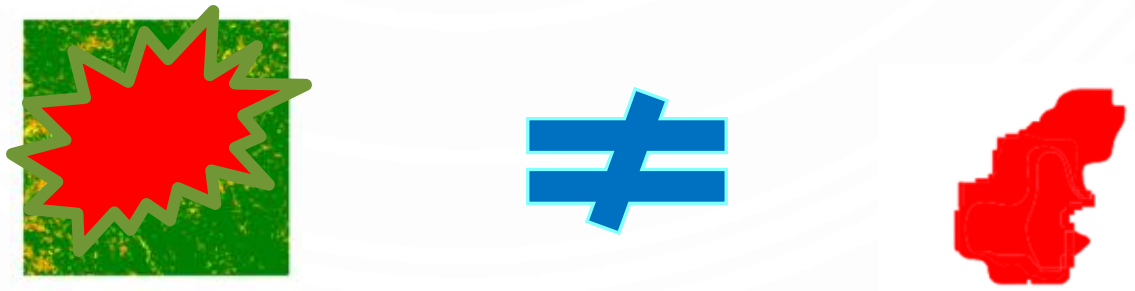
- **Build a SURROGATE MODEL using RNN** - Use a recurrent neural network to train a surrogate model of a wildfires predictive model.
  - **Step 2**: Use the RNN model with background data (`Ferguson_fire_background`) to make a forecast.



What does it look like?

OBJECTIVE 1

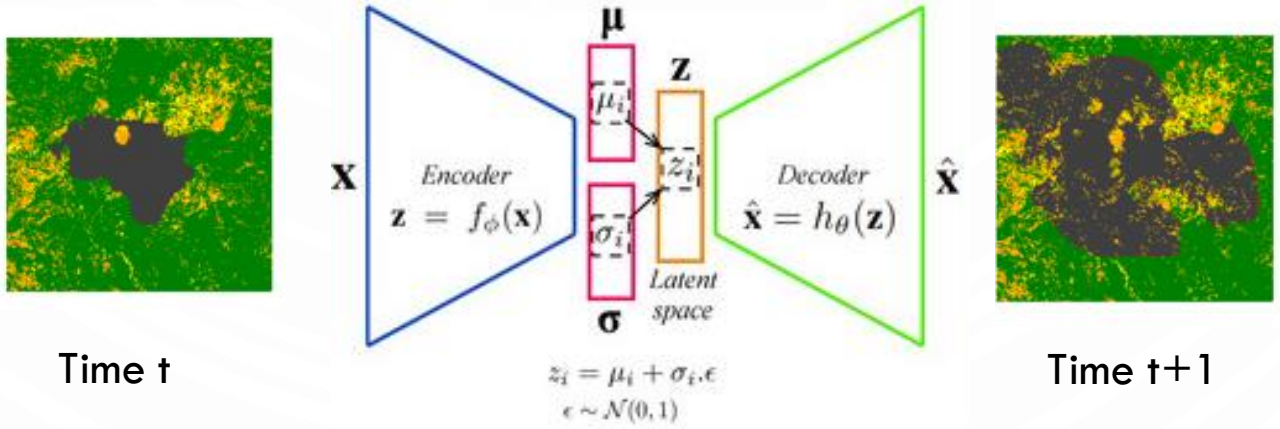
- **Build a SURROGATE MODEL using RNN** - Use a recurrent neural network to train a surrogate model of a wildfires predictive model.
  - **Step 3**: compare your forecasted results with satellite data (`Ferguson_fire_obs`) and compute the MSE between your forecast and the satellite data. Submit both code (all three steps in the same notebook) and MSE.



Time t+1

OBJECTIVE 2

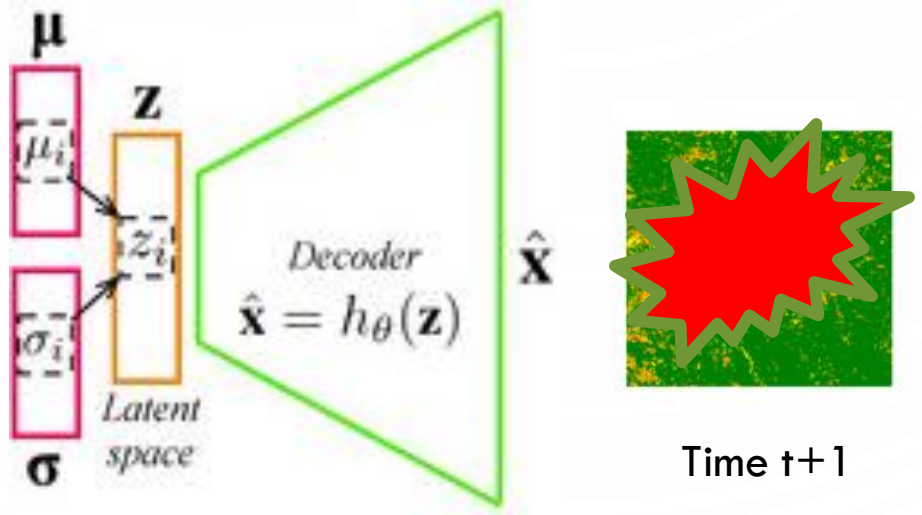
- **Build a SURROGATE MODEL using GENERATIVE AI** - Use a generative AI method to train a wildfires generative model.
  - **Step 1**: Use the model data for training (`Ferguson_fire_train`) and test the model using the model data for testing (`Ferguson_fire_test`).



Note: you can use any generative model. Variational AE could be a good option.

OBJECTIVE 2

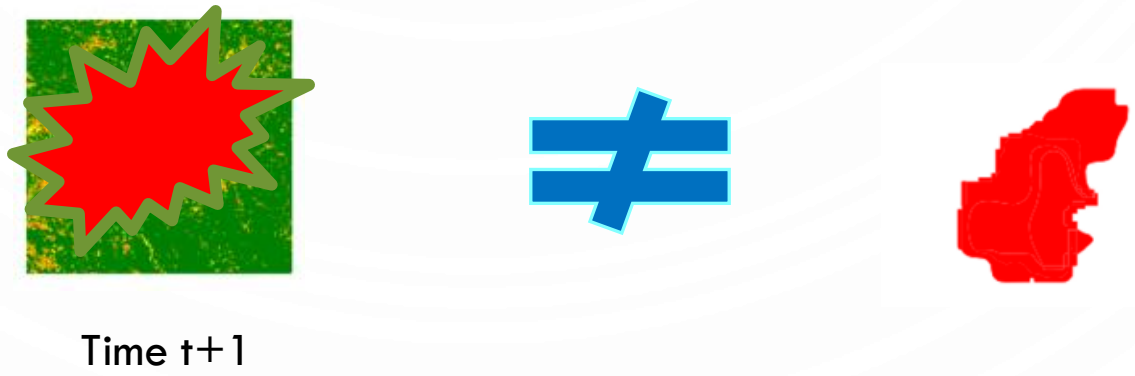
- **Build a SURROGATE MODEL using GENERATIVE AI -** Use a generative AI method to train a wildfires generative model.
  - **Step 2**: Use the wildfire generative model to make a forecast.



What does it look like?

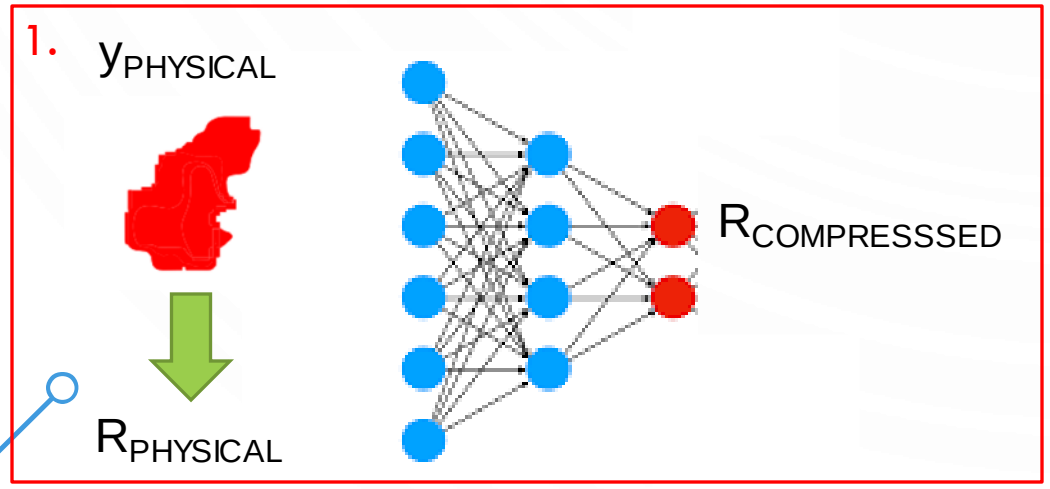
OBJECTIVE 2

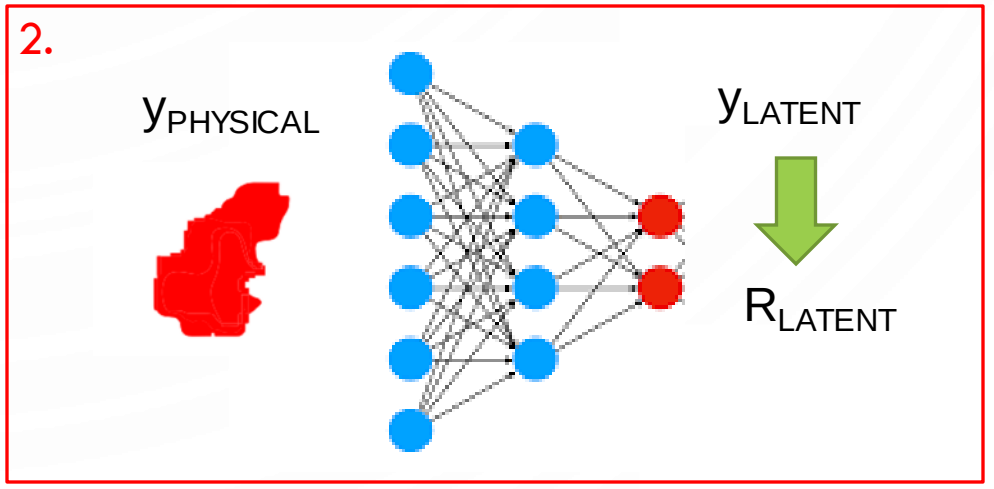
- **Build a SURROGATE MODEL using GENERATIVE AI** - Use a generative AI method to train a wildfires generative model
  - **Step 3**: compare your forecasted results with satellite data (`Ferguson_fire_obs`) and compute the MSE between your forecast and the satellite data. Submit both code (all 3 steps in the same notebook) and MSE.



OBJECTIVE 3

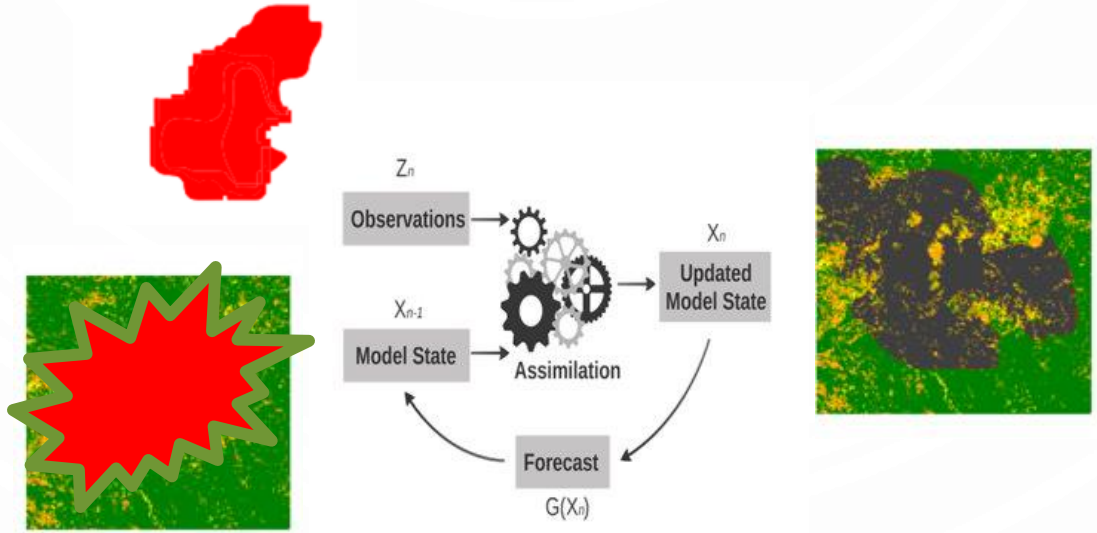
- **CORRECTION using Data Assimilation** - Perform Data Assimilation with the results of your RNN model and your wildfires generative model. Data Assimilation **must be performed in a reduced space**.
  - **Step 1**: Compute the error covariance matrices for the background data (matrix B) and satellite data (matrix R) in the data assimilation model. The observation error covariance matrix R is usually diagonal. This time it must be computed using satellite data and then used to perform DA in a reduced space. There are two main strategies:
    1. **compute R in the physical space and then compress it**
    2. **compress the data and compute R in the compressed space**





OBJECTIVE 3

- **CORRECTION using Data Assimilation** - Perform Data Assimilation with the results of your RNN model and your Generative model. Data Assimilation must be performed in a reduced space.
    - **Step 2**: perform **data assimilation** in a reduced space using satellite data (`Ferguson_fire_obs`) and background data (`Ferguson_fire_background`) and submit both code and MSE before and after performing DA.



Note: in the folder with the background files you will have the model data already selected in time steps corresponding to the observations.

AI FOR NATURAL HAZARDS.

ANY SCIENTIFIC CONTRIBUTION CAN HELP

SAVE MILLIONS OF LIVES EVERY DAY!

THANK YOU FOR YOUR CONTRIBUTIONS TODAY.