**Project Title:** Deep Learning model to estimate land-surface temperature in Israel

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The goal of this project is to build a deep-learning model to estimate land surface temperature in Israel at a 1x1 km resolution. The Land Surface Temperature (LST) is the radiative skin temperature of the land surface, as measured in the direction of the remote sensor. Historical LST data is available at a 1x1 km resolution, however we would like to see if we can use this data as a target for a deep learning model to learn to downscale temperature data to a finer resolution.

Available Data (For Israel):

* Historical Hourly LST data for the past 20 years. Data includes:
  + lat, long of observation
  + Date & Hour in day
  + LST temperature
* Topography:
  + lat, long
  + height (above sea level)
* Vegetation index from satellite imaging (NDVI) - at a 1x1 resolution
* Additional information (e.g. 9x9 Air temperature, land use, …) may be also available - to be possibly used in the project

[shilo.shiff@biu.ac.il](mailto:shilo.shiff@biu.ac.il) - will provide the data for this project.

Learning Task:

The goal of the deep learning model is to estimate the 1x1 km resolution land surface temperature given the surrounding topography.

For every such 1x1 km pixel, a 9x9 ‘patch’ surrounding the pixel as in the following illustration:

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The overall LST of the 9x9 grid at a given time will be calculated as the average of the 81 LST observations at the same time. Similarly, the average height of the 9x9 grid will be calculated.

The difference between the 9x9 LST and center pixel 1x1 LST will be the target value to predict. Evaluation of the regression problem will be measured via RMSE.

For every such observation, the input to the model will include:

* The Average height of the 9x9 grid
* The average LST of the 9x9 grid
* 81 height diffs (difference between pixel height to the average height for every 1x1 pixel in the grid)
* The day in the the year (0-365, consider transform via sine and cosine)
* The time in the day (0-24, consider transform via sine and cosine)
* lat, long of center pixel
* We may add additional features as we progress (e.g. NDVI

Project work includes finding the optimal feature representation and deep learning neural net architecture (# layers etc, ) as well as analysis of the results.

It is important to test the model on unseen (held out) pixels and dates.

Research Questions:

1. Can you improve RMSE predictions results over the simple baseline of always predicting 0 (temp of 1x1 center pixel identical to the 9x9 average).
2. What is the optimal DL model
3. How the various features impact the prediction