
Climatological Maps of Mars Using Supervised and Unsupervised Learning

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The Mars climate exhibits significant variability across the planet, including tropical ice clouds, polar carbon dioxide ice caps, and global dust storms. In this project you will apply machine learning methods to create a catalog of climate on Mars to aid research into the climate of present-day Mars.

Climate maps are used as reference tools in the discussion of climate and climate change on Earth (Beck et al., 2018), and on Mars (Hargitai, H., 2010). In this project you will build a new climate map of Mars using output from climate model simulations of the Martian system and data collected by orbiting spacecraft and landed instruments.

You will process and categorize the simulated data and observations using supervised (e.g. Support Vector Machines) and unsupervised learning (K-means, DBSCAN) from `scikit-learn` to identify regions of similar climate based on criteria you develop during the project.

You will then generate a global map of the Martian climate (similar to Hargitai, H. (2010)) to help researchers discuss the different regions on the surface and help in planning future missions to the surface.

The project requires knowledge of Python and numerical data analysis. Previous experience with atmospheric physics (e.g. PHY392) and machine learning (not necessarily “deep” learning) is useful but not necessary.

For more information, please feel free to contact me by email: clee@atmosp.physics.utoronto.ca

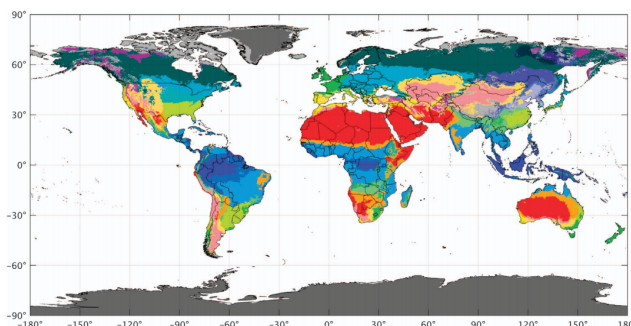


Figure 1: Climate map of the Earth, showing regions with similar climate over the period 1980–2016 (Beck et al., 2018). [wikipedia.org/wiki/Climate](https://www.wikipedia.org/wiki/Climate)

References

- Beck, Hylke E. et al. (2018). “Present and future köppen-geiger climate classification maps at 1-km resolution”. In: *Scientific Data* 5, pp. 1–12. ISSN: 20524463. DOI: 10.1038/sdata.2018.214.
- Hargitai, H. (2010). “Mars Climate Zone Map Based On TES Data”. In: *41st Lunar and Planetary Science Conference (2010)*, p. 1199.