Machine Learning applied to Planetary Sciences

PTYS 595B/495B

Leon Palafox

Front matter

- Overview
  - We will focus in the study of Machine Learning techniques, and their applications. Emphasis will be on geological, planetary and astronomical applications. Course will cover basic and state of the art techniques, as well as validation techniques for each algorithm.
- Objective
  - Students will be able to implement and validate different Machine Learning techniques in datasets related to Planetary Sciences, Earth Sciences and Astronomy. Students will learn the difference between supervised and unsupervised learning.

Logistics

- Lecture Times:
  - M, W from 10:00 am to 10:50 am, Room 312
- Course Website: https://leonpalafox.github.io/MLClass/
- Office hours: After lectures and from 13:00 to 14:00 on T, T.

Evaluation

- The evaluation will consist of:
- Final Project will be 60% of the Final Evaluation.
  - The final project will consist in the correct use and validation of one Machine Learning technique in a dataset related to the student field of study.
  - The students can form teams of up to three persons.
  - Graduate students and teams need to write an 8-page report on the data, methodology and conclusions. In addition, make a 10-minute presentation of their work.
- In class participation will be 40% of the Final Evaluation
  - In class participation will consist on programming assignments, assigned readings reports and two quizzes.
    - Graduate students quizzes will consists of five questions.
- There will be an additional 10% extra credit opportunity by submitting additional reports, extracurricular projects and extra participation during the classes.
- Homework assignments submitted after the established due date will be accepted. Assignments submitted after the due date will have a penalty of 20%.
- Assignments will be published in the WP along with the slides.

Additional credit

- Quizzes have extra credit (1 bonus question)
  - Bonus question can be on popular culture, current events, etc.
- Class scribe gets extra credit.
- Answering questions gets extra credit.
- Paper report gets extra credit.

Rules

- Attendance is not mandatory (Just for the quizzes).
- You can use your cellphone/pager.
- You can’t eat, but you can drink water. (LPL rules).
  - I guess coffee should be fine as well.

Policies

- Academic Integrity Policy
- Threatening behavior Policy
- Notification on offensive content.
- Accessibility and Accommodations

Questions?

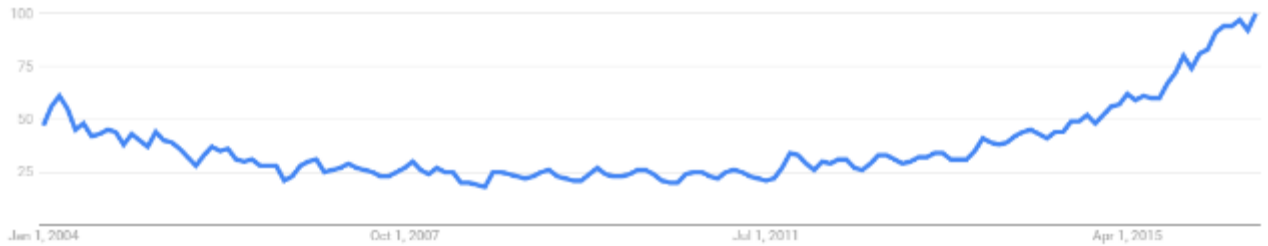
What is Machine Learning

- During the 1980s-1990s, much of what we call now Machine Learning was referred as Artificial Intelligence (AI). AI was an umbrella term for any field of study concerned with automation via learning.
  - Neural Networks
  - Genetic Algorithms
  - Fuzzy Logic
  - Probabilistic Models

Renaissance of AI-ML

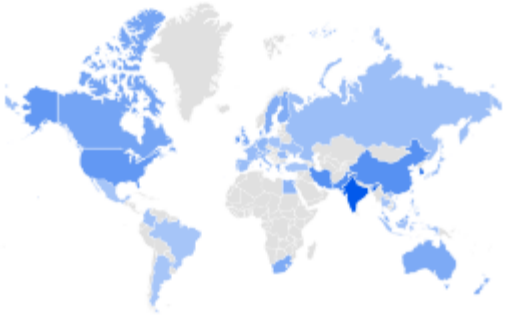
- At the late 1990s, and early 2000s, many people started to use more formal tools for learning, people with background in statistics and math started addressing the learning problem.
- AI was rebranded as Machine Learning (ML), and many algorithms from AI were absorbed into the ML community.
  - Support Vector Machines
  - K-Means
  - Linear Regression
  - Bayesian Inference

Interest over time



Interest by region

Region



1	South Korea	100
2	Singapore	99
3	India	99
4	Hong Kong	72
5	Israel	61

Related topics

Rising

1	Coursera - Company	Breakout
2	Deep learning - Field of study	Breakout
3	Microsoft Azure - Computer application	Breakout
4	scikit-learn - Software	Breakout
5	Apache Hadoop - Software	Breakout

Related queries

Rising

1	machine learning coursera	Breakout
2	coursera	Breakout
3	azure machine learning	Breakout
4	azure	Breakout
5	machine learning wiki	Breakout

ML has beaten the unbeatable

Google's Computer Program Beats Lee Se-dol in Go Tournament

By CHOE SANG-HUN · MARCH 15, 2016

Lee Se-dol with his daughter Lee Hye-lim on his way to the last Go match with Google's AlphaGo artificial intelligence program in Seoul, South Korea. Kim Hong-Ji/Reuters

SEOUL, South Korea — Ending what was billed as the match of the century, a Google computer program defeated a South Korean master of Go, an ancient board game renowned for its complexity, in their last face-off on Tuesday.

The program AlphaGo's 4-1 victory was a historic stride for computer

Everybody is doing ML

Apple acquires machine learning startup Turi, formerly known as GraphLab and Dato

JORDAN NOVET AUGUST 5, 2016 1:51 PM

TAGS: APPLE, DATO, GRAPHLAB, MACHINE LEARNING, TOP STORIES, TURI

Image Credit: Mr. Gray/Flickr

Apple has acquired Turi, a machine learning software startup. The startup formerly went by the names GraphLab and Dato.

Apple provided no information other than its standard boilerplate message for confirming acquisitions. "Apple buys smaller technology companies from time to time, and we generally do not discuss our purpose or plans," an Apple spokesperson told VentureBeat in an email. (Hat tip to Geekwire for breaking

Press Releases

HyTrust Unveils Enhanced Workload Security Solutions for the New Multi-Cloud World

TwoVista Raises $8.4M to

Business

Crystal Ball for Corn Crop Yields Will Revolutionize Commodity Trading

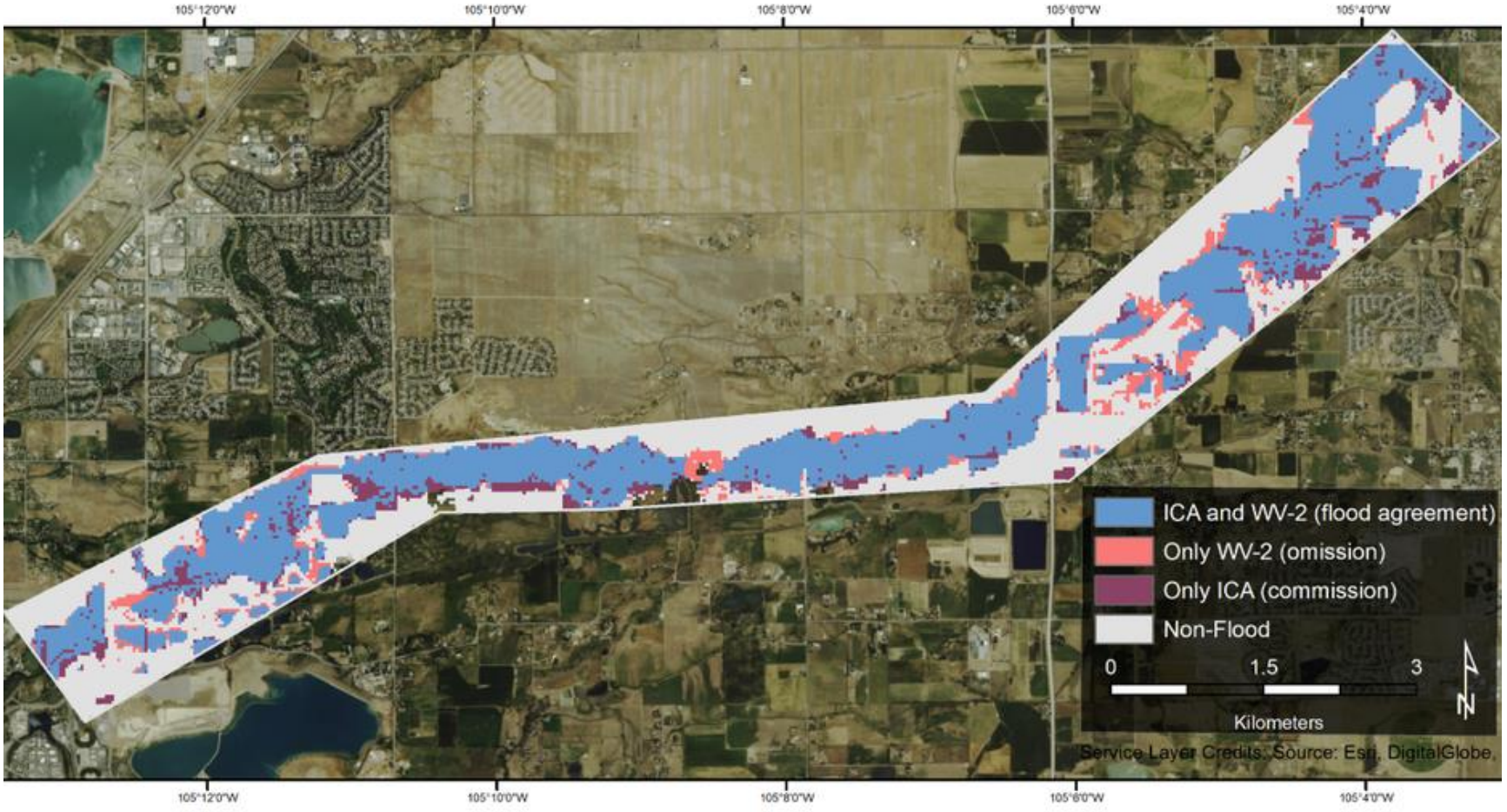
TellusLabs is using NASA imagery, machine learning, and expert knowledge about vegetation to deliver accurate, in-season agricultural yield estimates.

by Elizabeth Woyke August 9, 2016

Deriving financial insights from satellite images isn't a new idea, but TellusLabs is putting a twist on it. The Boston startup analyzes satellite imagery from NASA as well as weather data from the National Oceanic and Atmospheric Administration and seasonal, crop-growing information from the U.S. Department of Agriculture. It then uses machine-learning algorithms to generate intelligence about natural resources, such as predicting agricultural yields.

The strategy might sound similar to that of other satellite imagery analysis companies like Descartes Labs and Orbital Insight. However, TellusLabs plans to differentiate itself by applying scientific expertise in vegetation and climatology to its analysis, maintaining a narrow focus on natural resources, and quickly rolling out new products. Its goal is to be "a Bloomberg terminal for Earth signals." "There's a broad base of people who have to make tough decisions around natural resources, and we want to give them quality data, quickly," says TellusLabs CEO and cofounder David Potere.

Machine Learning in Planetary Sciences/Remote Sensing



Chignell, Stephen M., et al. "Multi-temporal independent component analysis and Landsat 8 for delineating maximum extent of the 2013 Colorado front range flood." Remote Sensing 7.8 (2015): 9822-9843.

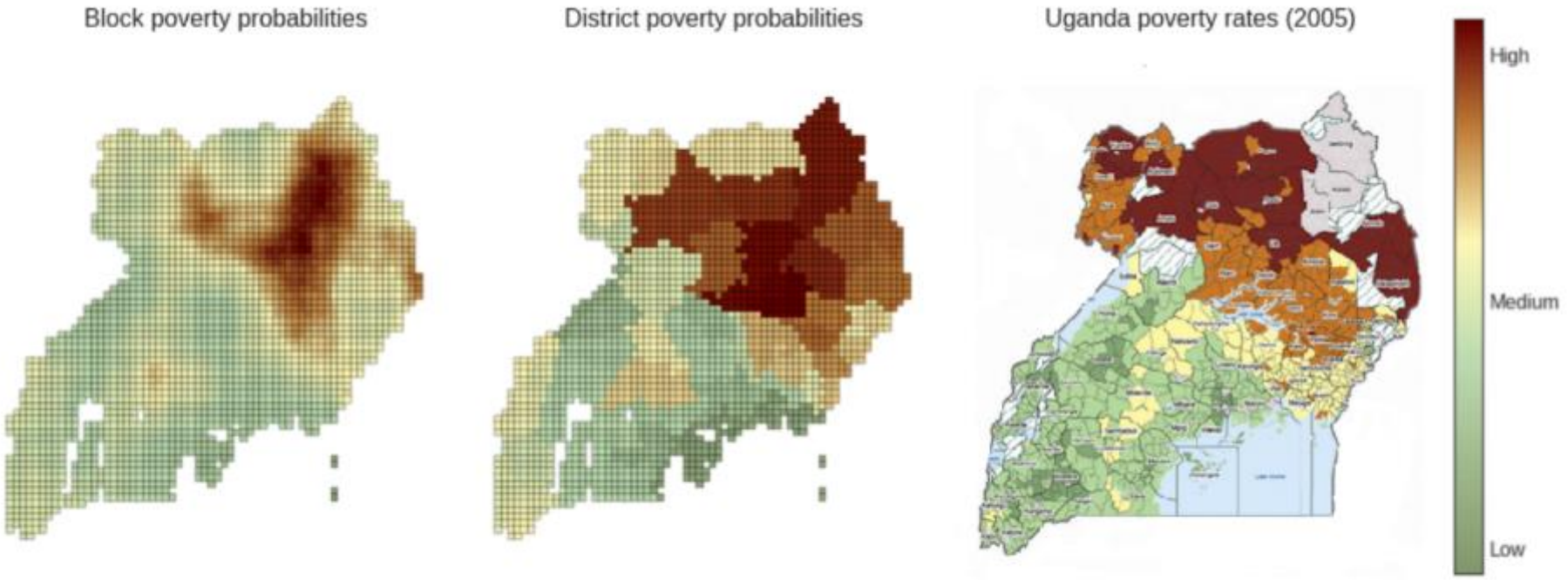
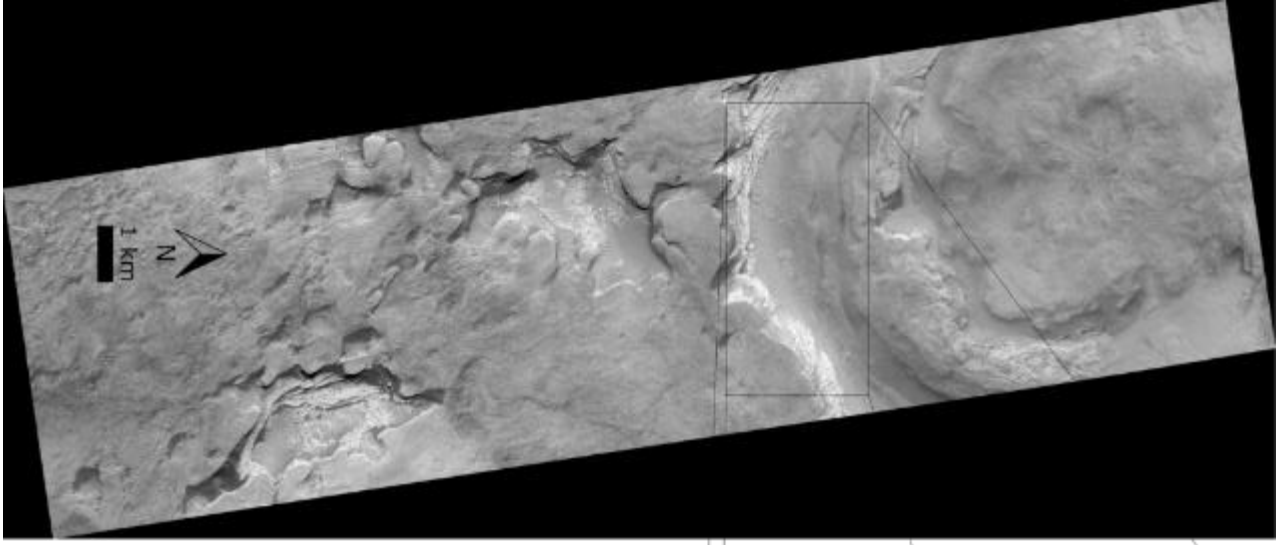


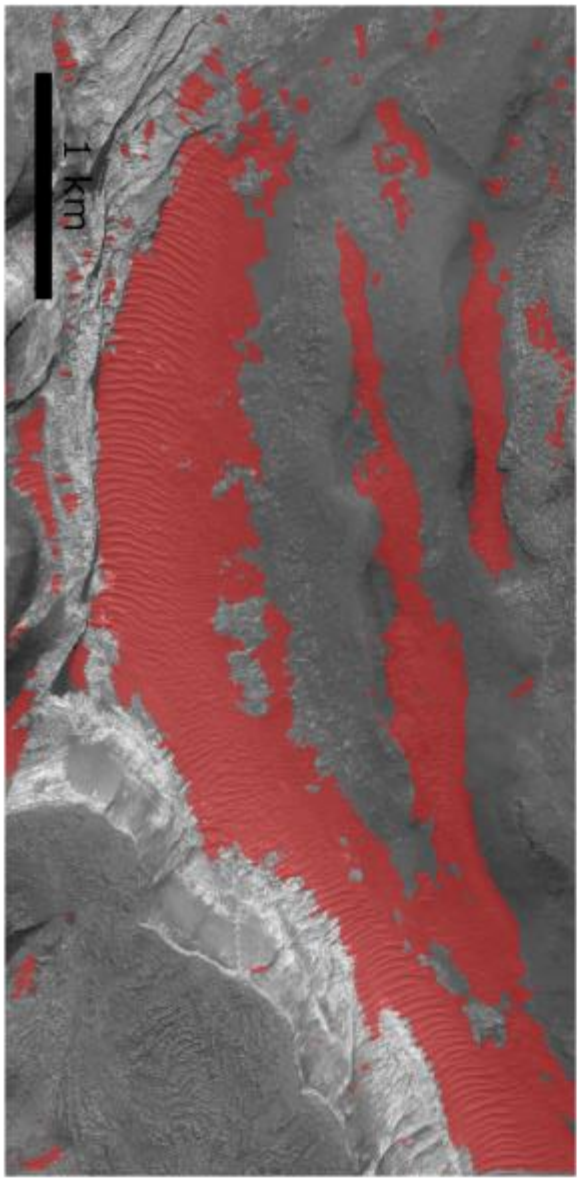
Figure 3: **Left:** Predicted poverty probabilities at a fine-grained 10km × 10km block level. **Middle:** Predicted poverty probabilities aggregated at the district-level. **Right:** 2005 survey results for comparison (World Resources Institute 2009).

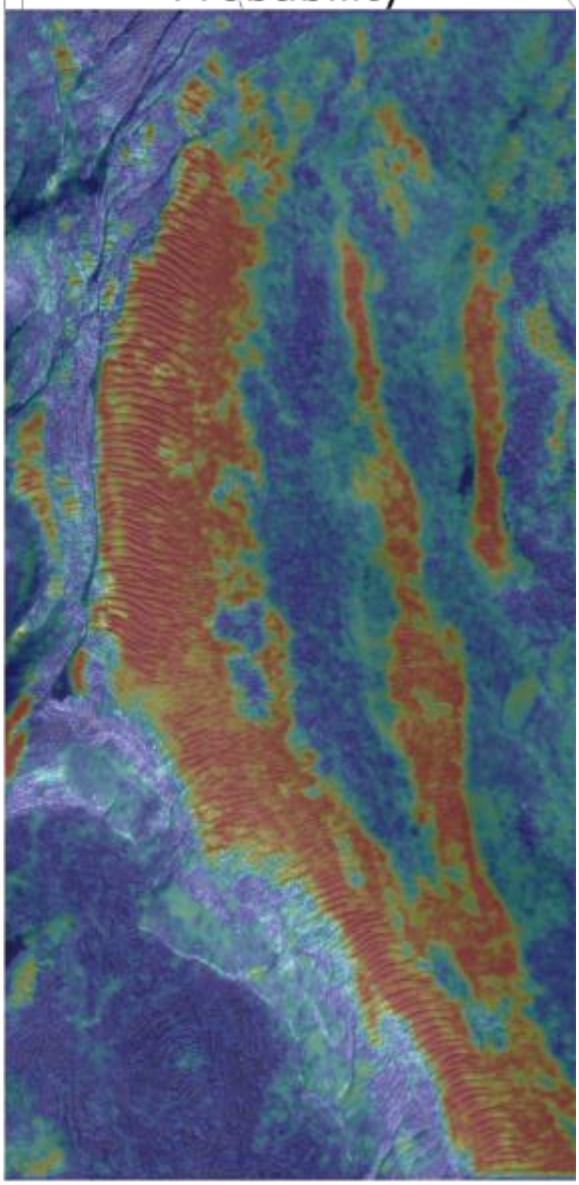
Xie, Michael, et al. "Transfer learning from deep features for remote sensing and poverty mapping." arXiv preprint arXiv:1510.00098 (2015).

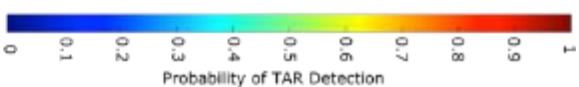


Final Mapping

Combined Probability







Questions?