

To Bloom or Not to Bloom

The Great Bloom Theory Team

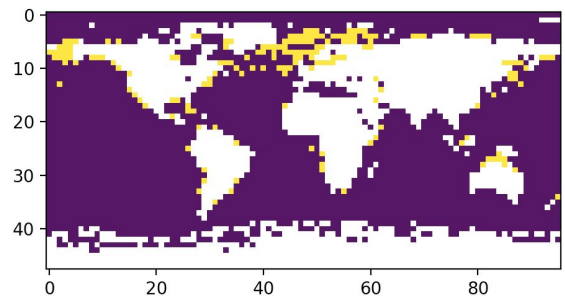
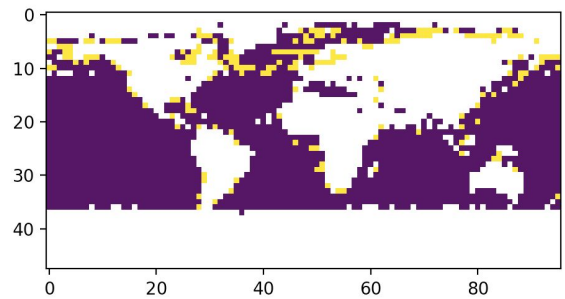
NASA Space Apps Challenge



Problem - algal blooms



real



predicted



Why even bother?

- some algae release harmful toxins
- algae blooms use up lots of oxygen which results in marine life die offs
- afterwards, the decomposition of enormous amounts of bio-mass causes further environmental damage

We know the ways to prevent algal blooms...

- ultrasound
- aeration
- chemical control
- mixing

But we are yet to implement
accurate prediction methods

Proposed solution

- fetch sophisticated real-time NASA satellite data which is already available
- preprocess it in sensible manner
- use it in modern machine learning models
- discover unknown patterns
- predict and apply prevention methods

...and save the day!

Data used

- NASA's Earth Observing System Data and Information System

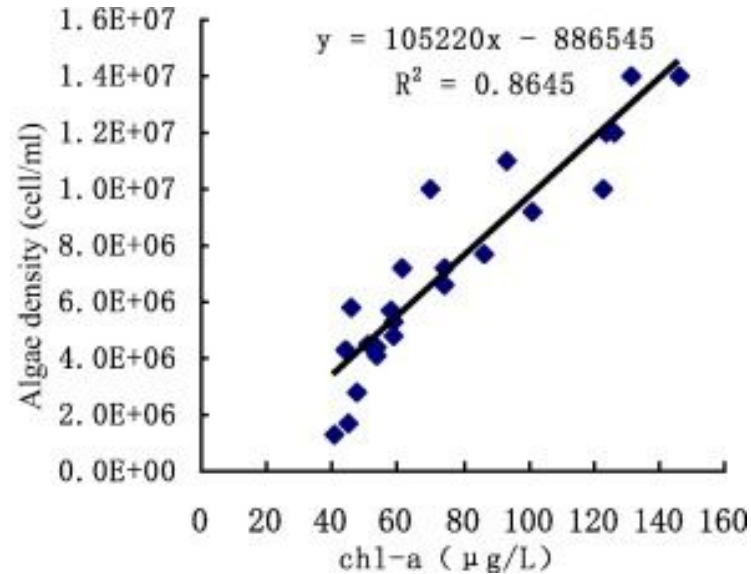
MODIS Aqua L3 - CHL, FLH, NSST, PIC, POC

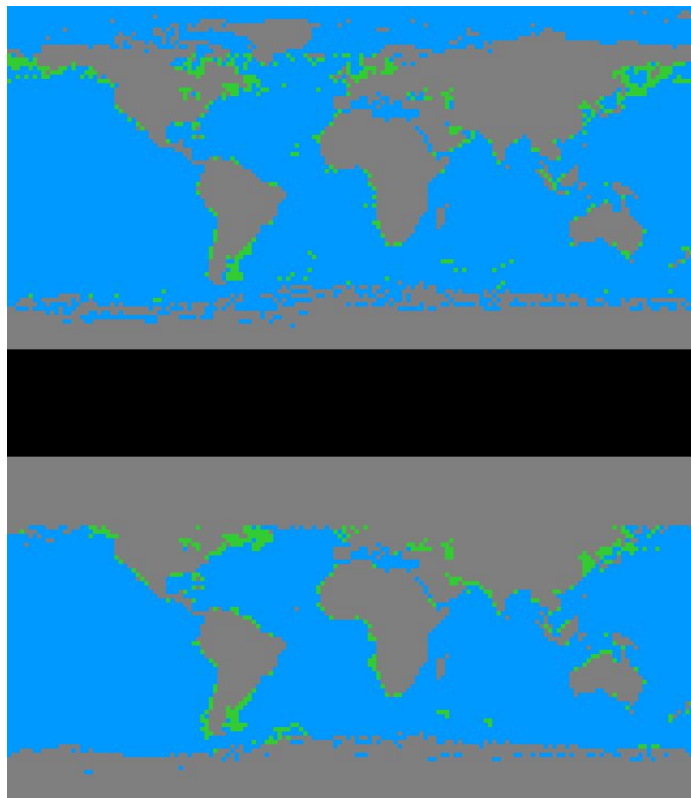
OSCAR - currents

- European Centre for Medium-Range Weather Forecasts public datasets

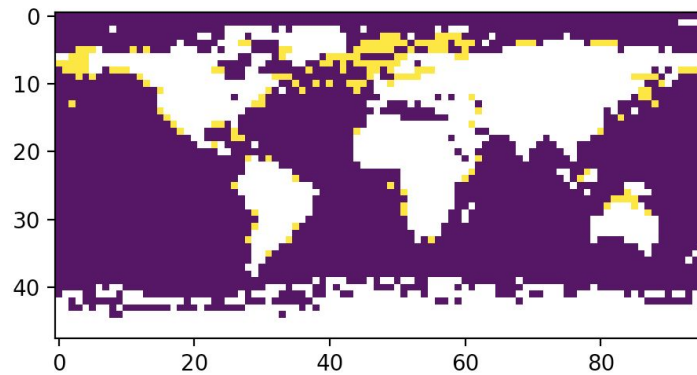
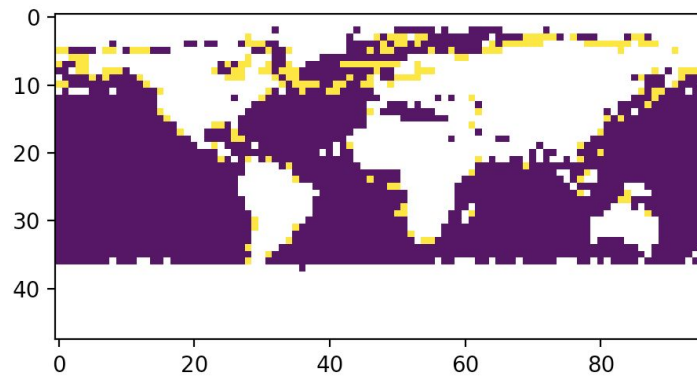
SO, CO, SALT

Measuring algae bloom



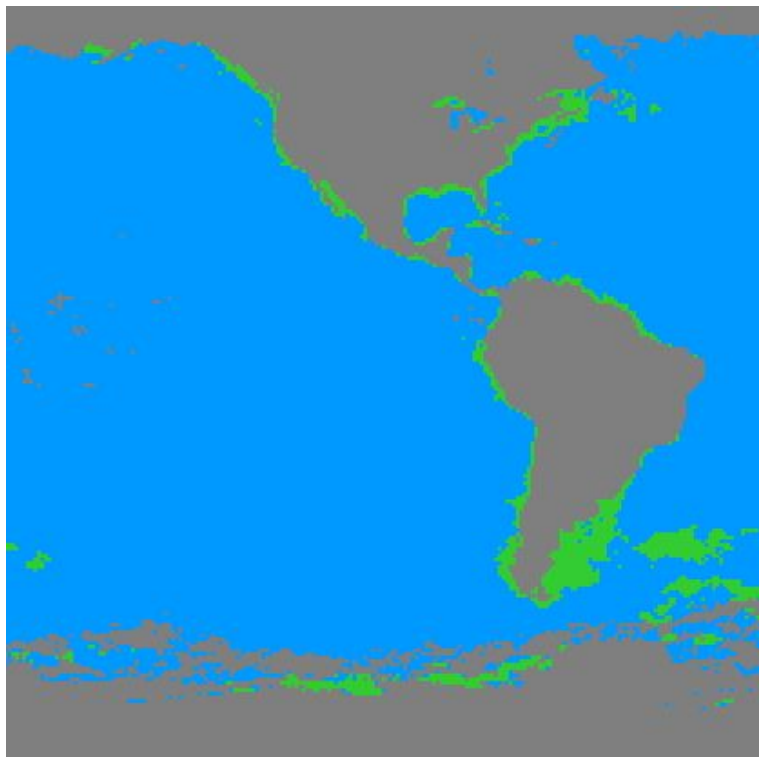


real



predicted

real



predicted



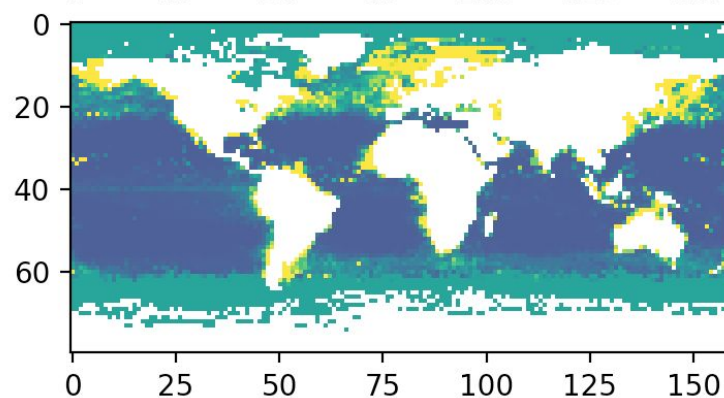
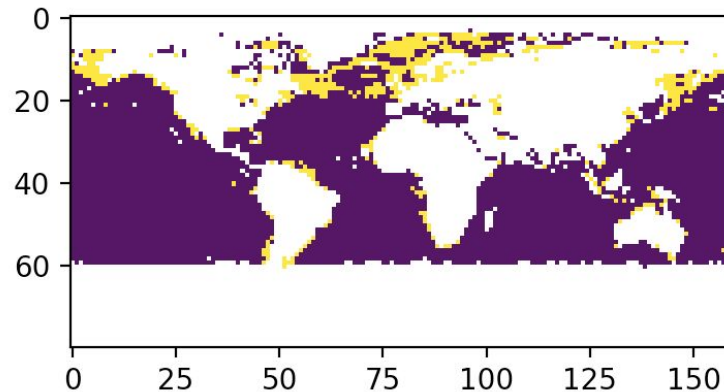
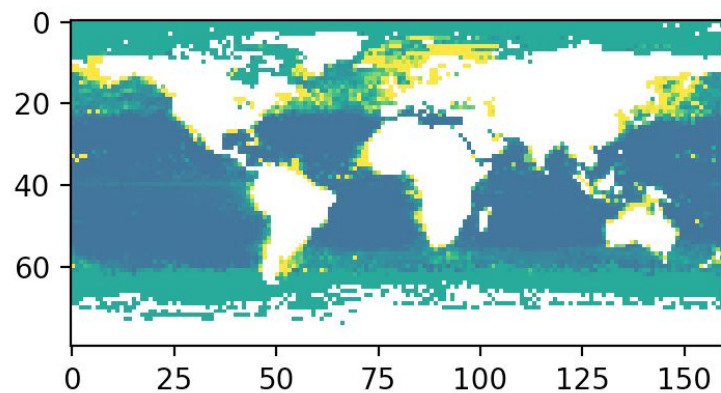
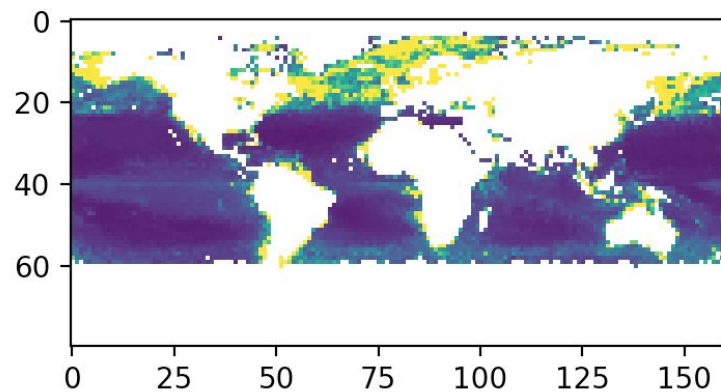
real



predicted

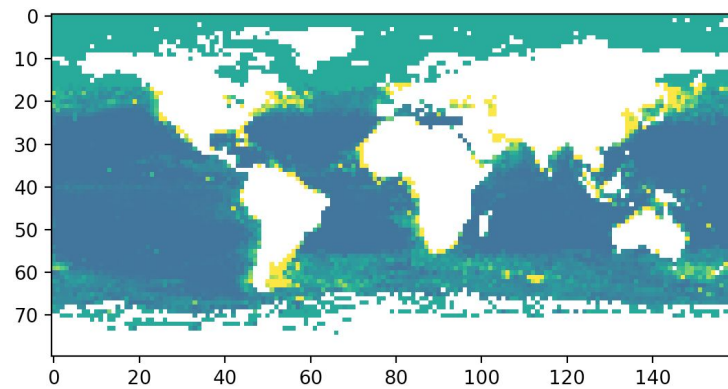
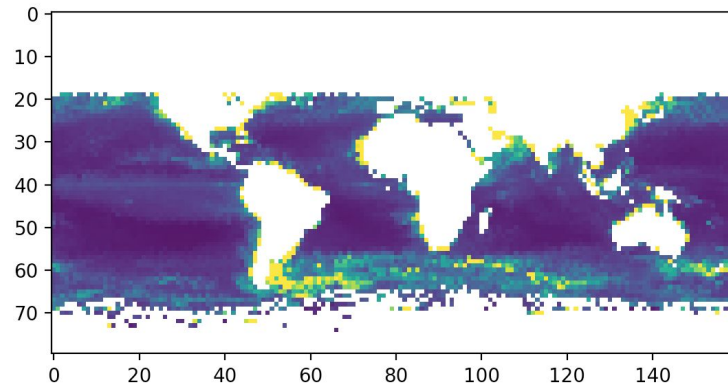


real



predicted

real

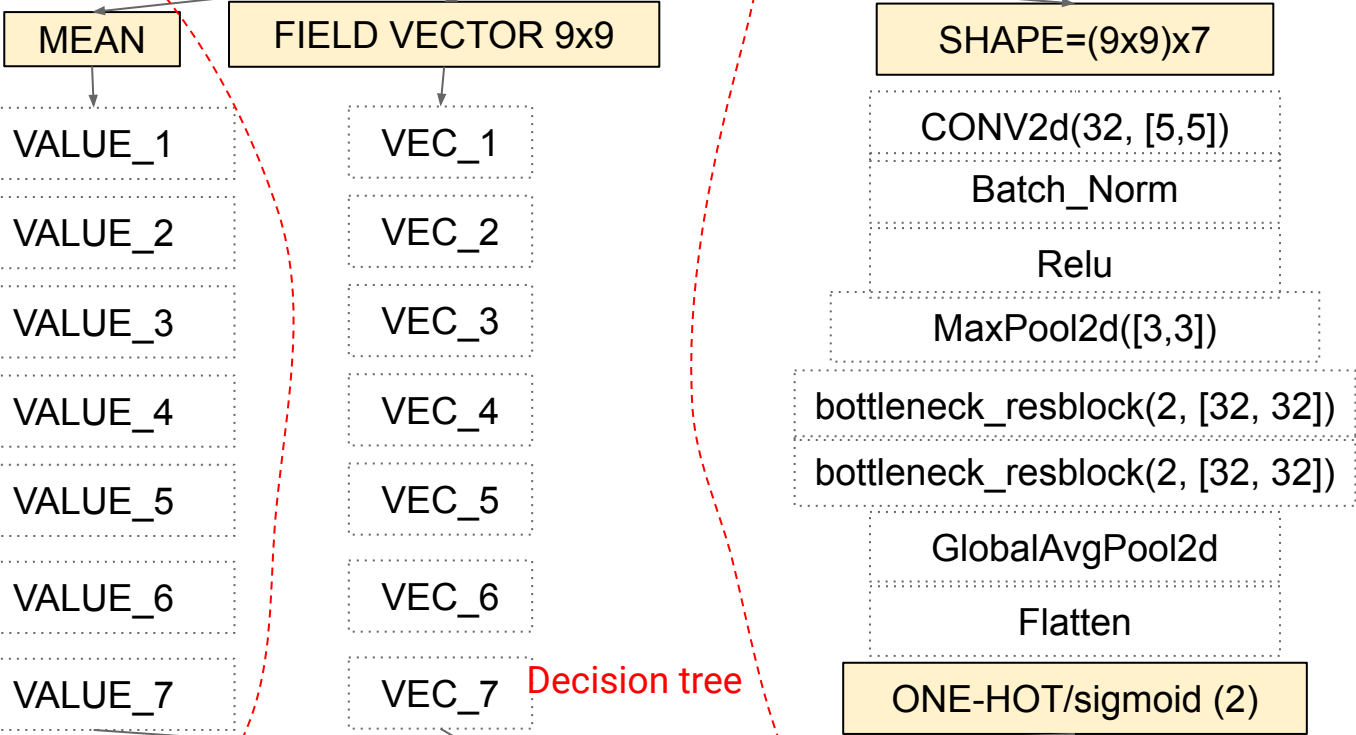


predicted

BINARY_ACC(BLOOM):

~92.3%

NASA: MORIS, OSCAR, NOMAD
(100x100)km grid



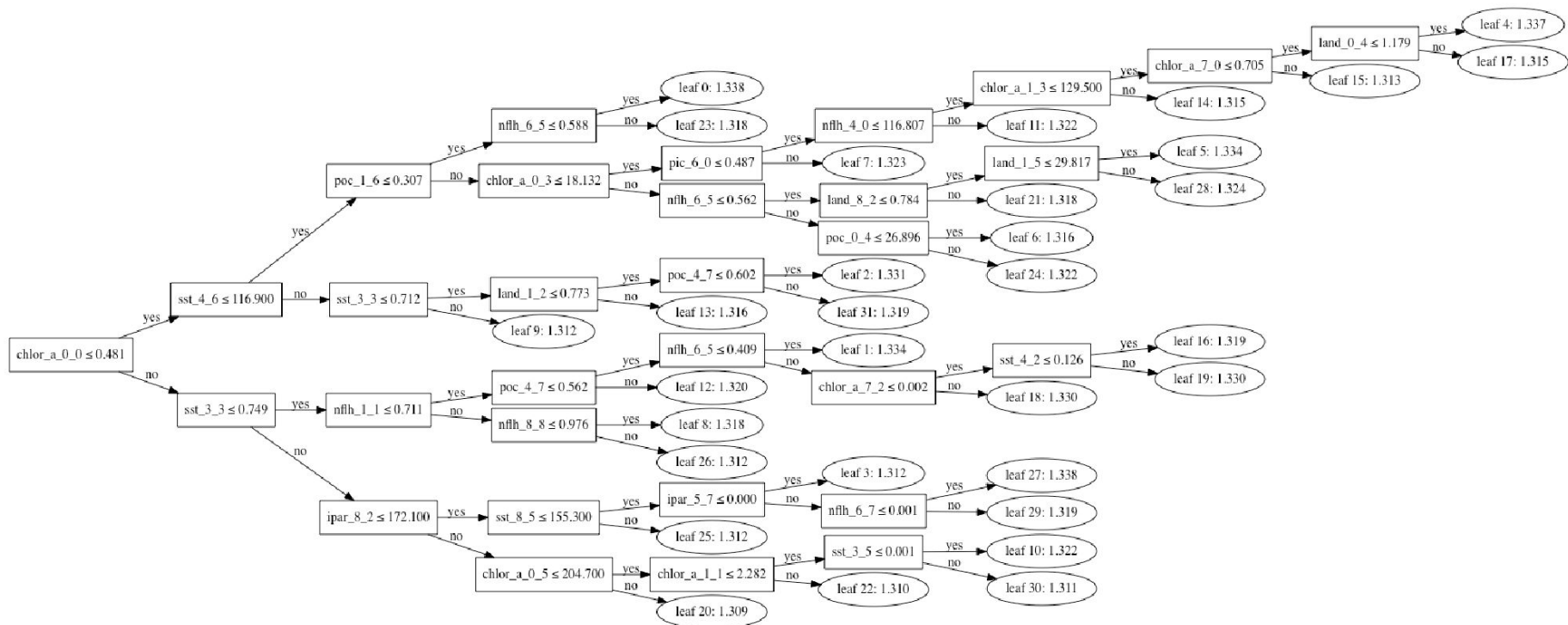
Decision tree

Decision tree

Ensemble learning: TreeMean, Tree, ResNet9pm

Neural network
(conv2d)

Correlations discovered



Impact

- stabilization of the ecosystem and seafood markets during global warming age
- limiting health hazards

References

- Analysis of algae growth mechanism and water bloom prediction under the effect of multi-affecting factor
- Cyanobacterial Harmful Algal Blooms: State of the Science and Research Needs
- <https://oceancolor.gsfc.nasa.gov/l3/>
- <https://apps.ecmwf.int/datasets/>
- <https://podaac-opendap.jpl.nasa.gov/opendap/>
- <https://www.ncbi.nlm.nih.gov>

Thank you for your attention.

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