



# ASTRAEA'S ALGORITHMS



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In a world struggling with the effects of global warming, an international organization is working to replant forests and capture more carbon. To fight climate change, their decisions need to be fair and effective.



### IN A CONFERENCE ROOM

Reforestation Areas :



Mia

I'm confused. These areas already have stable ecosystems. Why are we prioritizing them?

Eric

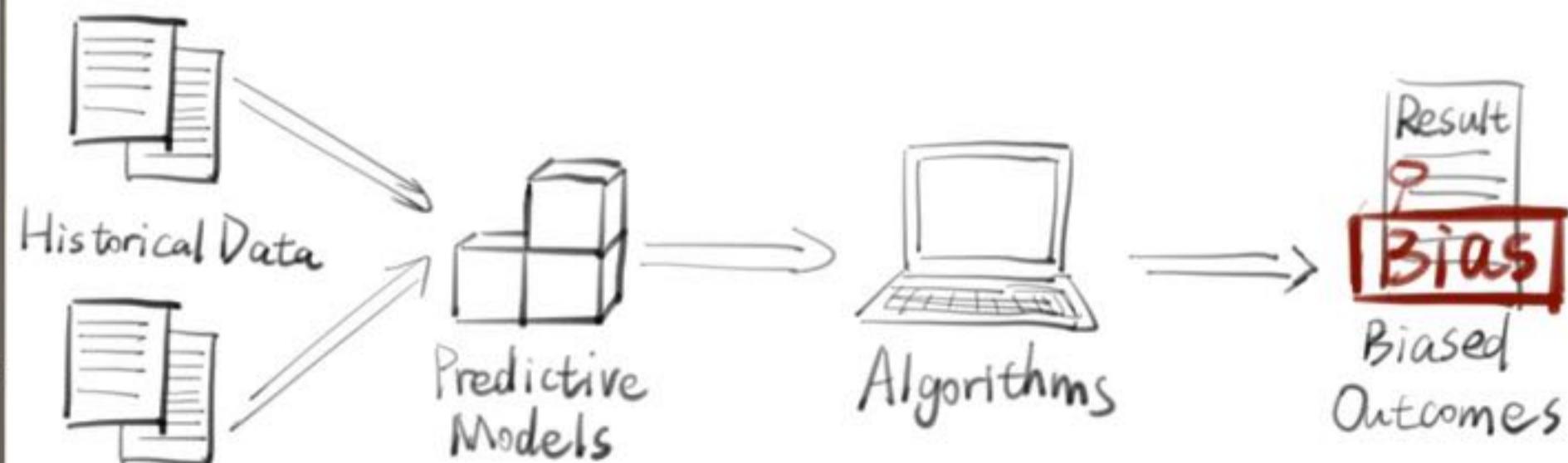
That's what the algorithm recommends. It uses data such as funding, infrastructure and political support.

### TEACHING MOMENT: What is Machine Learning?

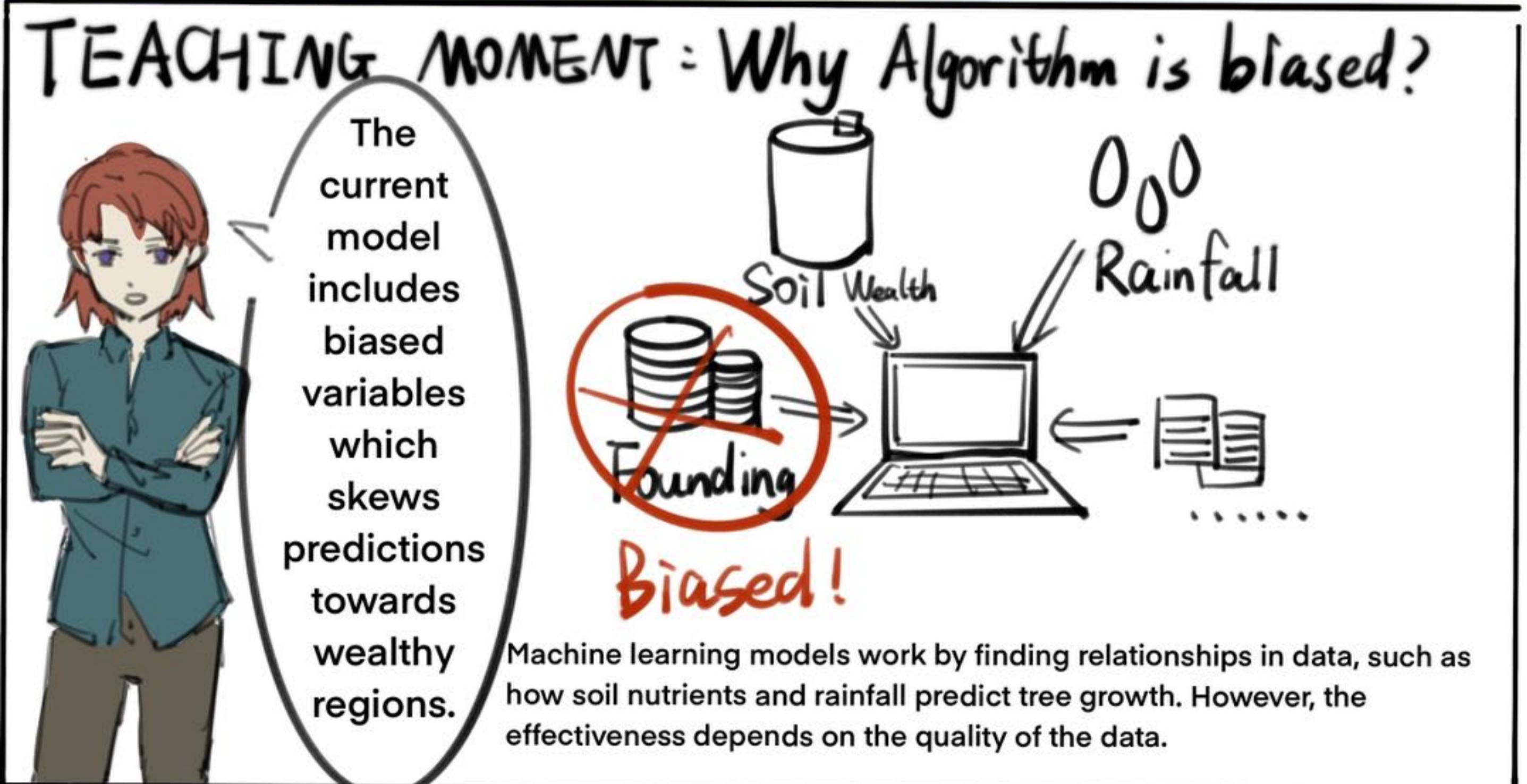


Astraea

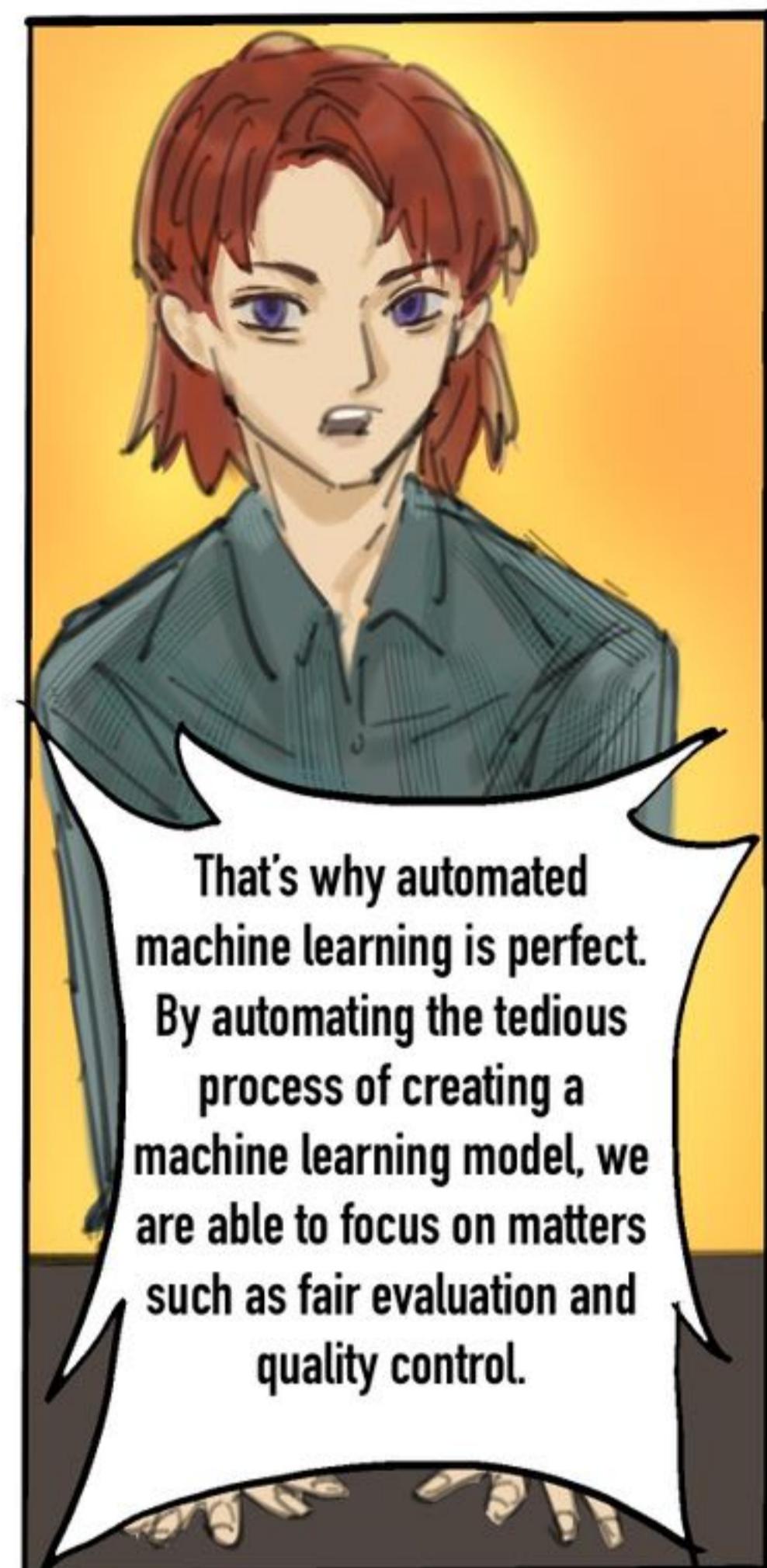
Machine learning is like teaching a computer how to find patterns in data. If you give it information about forests—like soil quality, biodiversity, and carbon absorption—it can predict future need for trees based on historical data. Best areas for reforestation could be later optimized with algorithms.



Machine learning uses historical data as input to predict outcomes (e.g., where to plant trees). However, if the data reflects existing inequalities, the model perpetuates them.



## BOSS' OFFICE



TEACHING MOMENT: Compare traditional ML to Auto ML  
Traditional: Manually model test. Auto: Automated model test.



Unlike traditional machine learning, which requires experts to manually test algorithms and tune them, automated machine learning (AutoML) automates tasks like feature selection, model optimization, and hyperparameter tuning.



## BACK TO THE WORK ROOM



Auto ML System

Soil Quality

Biodiversity

Founding

Bias Detected

Auto ML System

Priority areas: Historically Founding



80% overlap

We should also apply  
fairness indicators

Should we include funding availability as a variable?

No, that introduces bias. Let's focus on ecological factors like soil health, carbon absorption potential, and community vulnerability.

Simply remove the funding availability variable, is that enough?

Maybe, let's train the model again.

Wait, why are the results still skewed in favor of historically funded areas?

Looks like even without the funding variable, historical bias remains. Our data still prefers regions previously funded. To break this cycle, we need fairness metrics which ensure the predictions aren't skewed by past inequities.



## TEACHING MOMENT: About Auto ML

Auto ML System

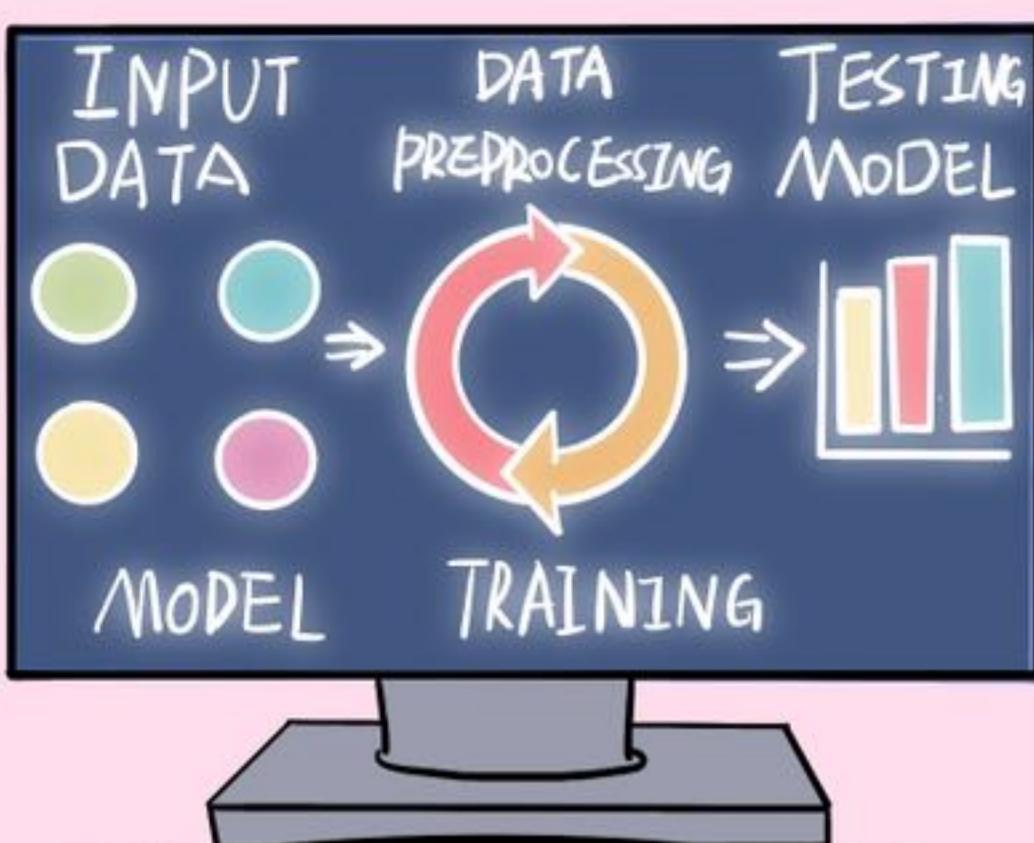
Soil Quality

Biodiversity

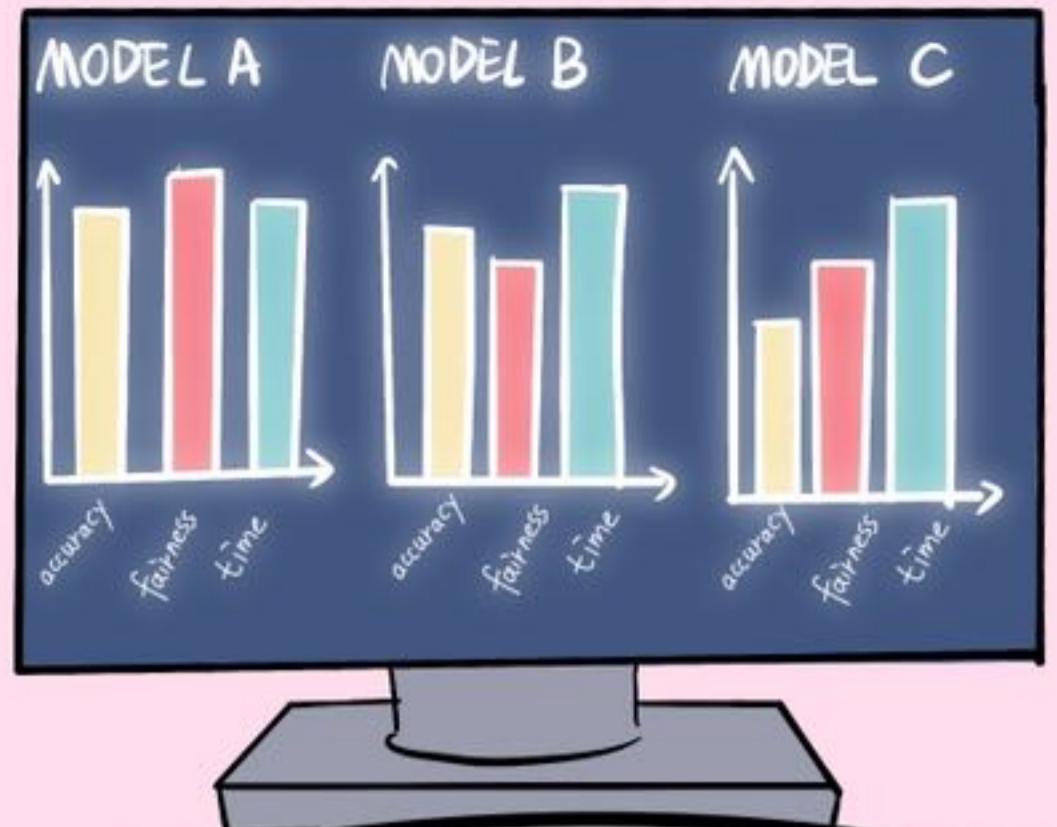
Founding

Bias Detected

AutoML optimizes not just for accuracy but also for fairness by excluding biased variables. Due to historical bias however, simply excluding "funding" may still lead to similar predictions. In order to break this cycle, metrics such as demographic parity are used which ensures that predictions are independent of the "funding" attribute.



The system is testing hundreds of combinations to find the best model. It's also checking for fairness, making sure no single region is unfairly favored.



It's not only optimizing accuracy, it's looking for models that are not biased toward any single region.

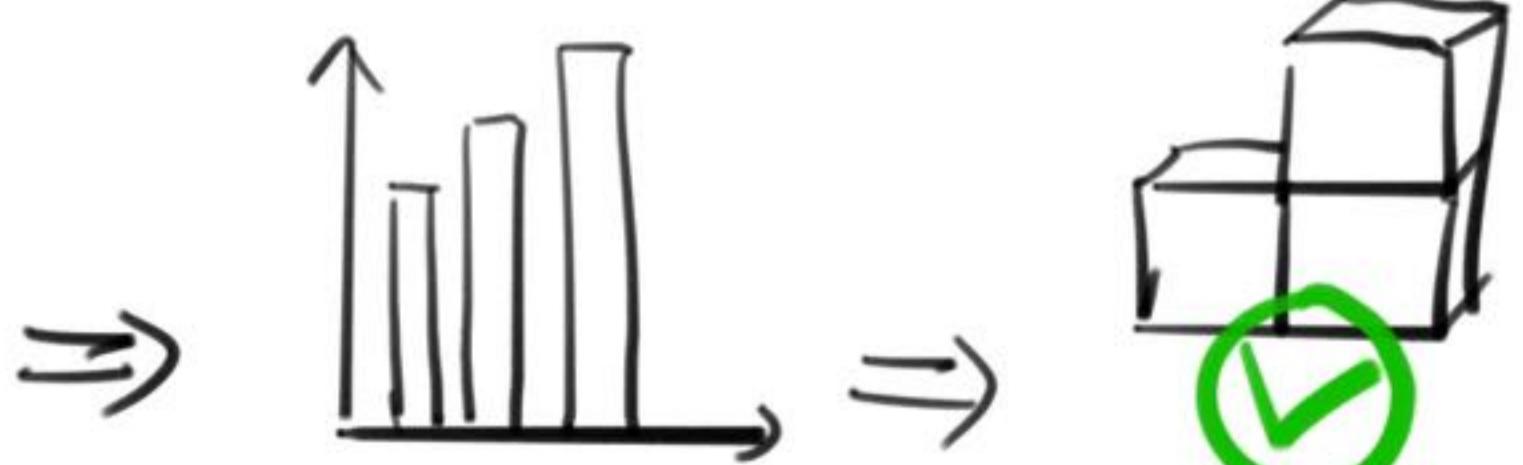
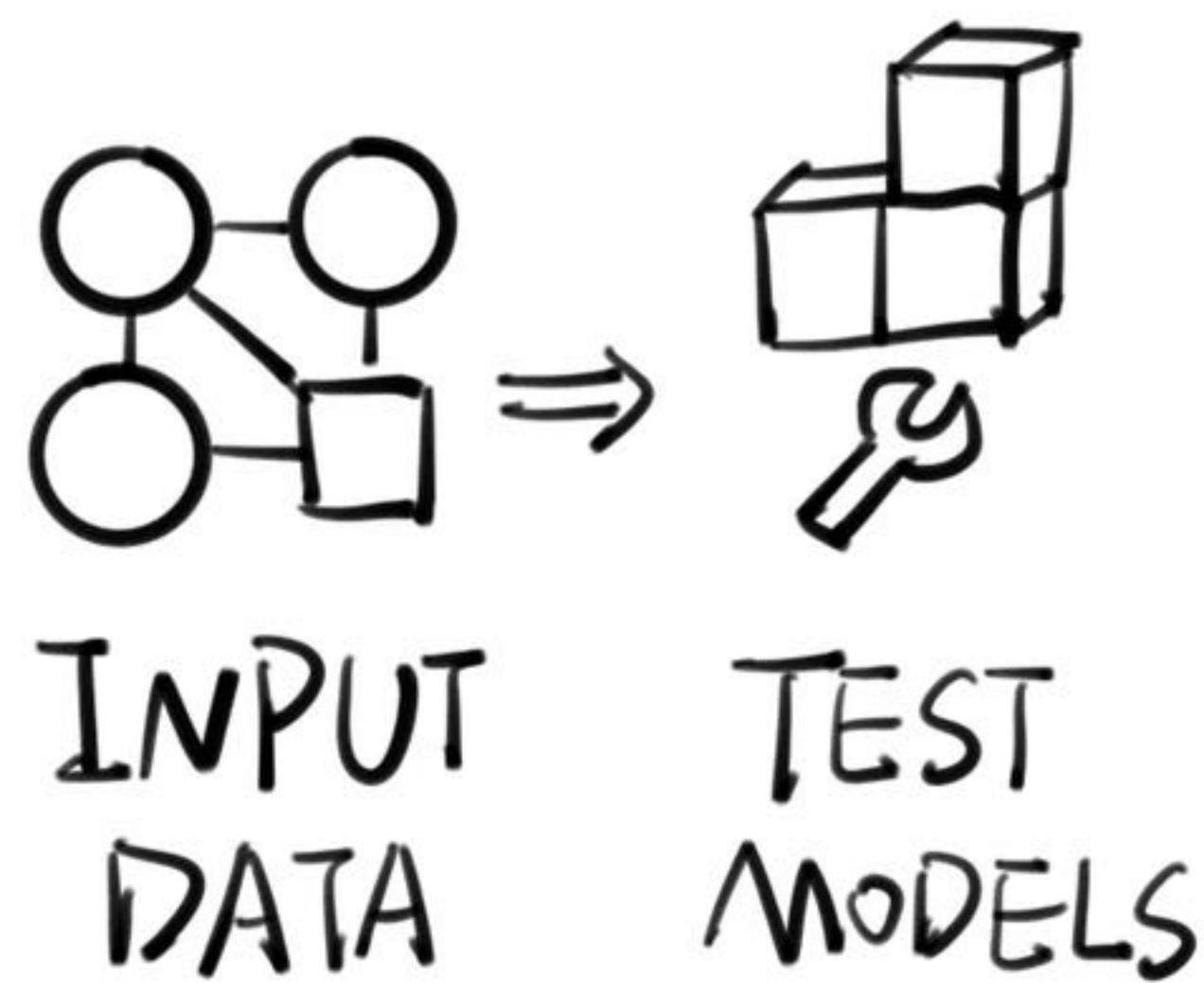
Found it! This is the model with the best performance and fairness score.



Reforestation Areas :

The predicted results look much fairer this time, with all regions having a chance.

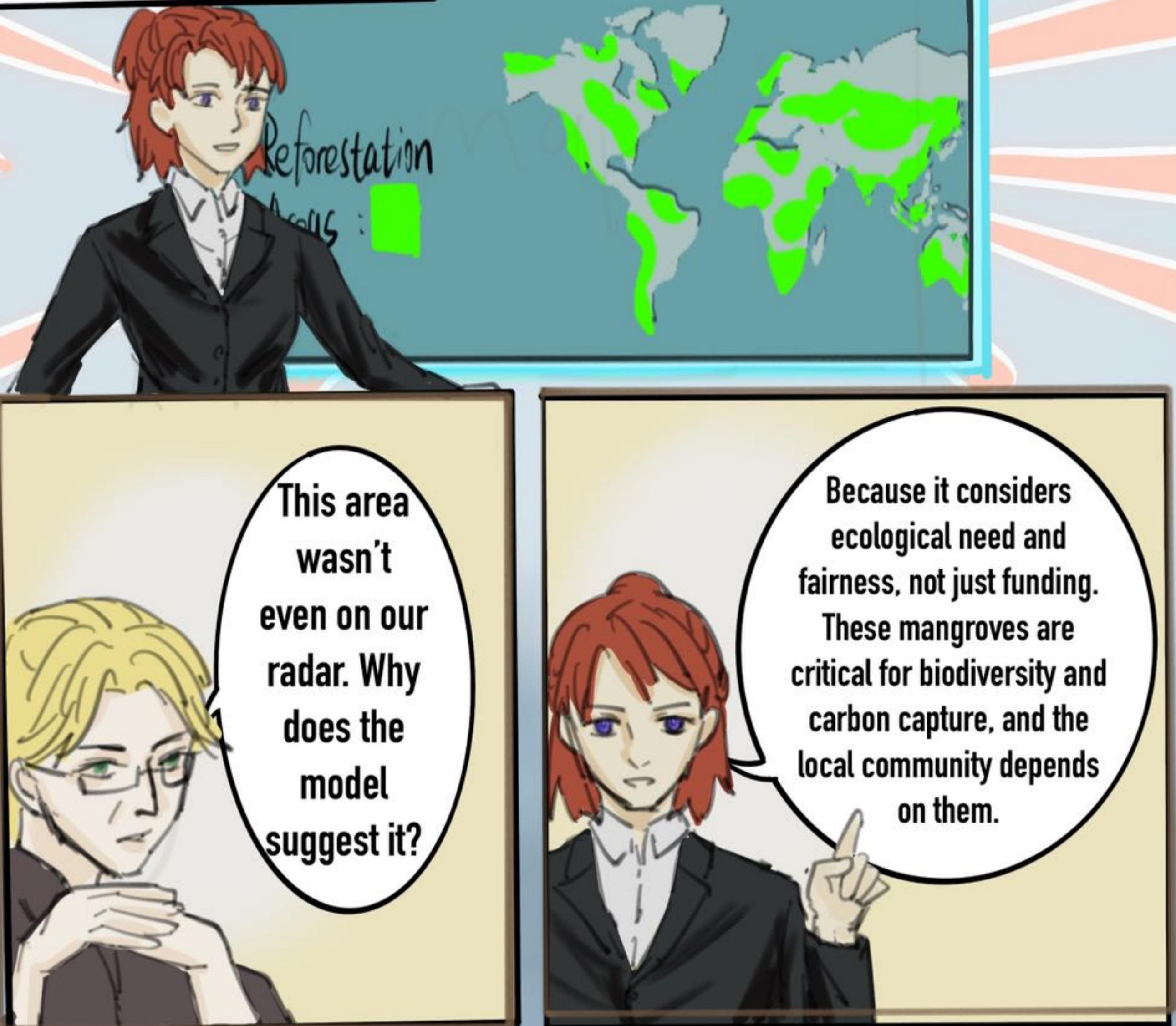
## TEACHING MOMENT: Auto ML's Process



EVALUATE  
FAIRNESS

SELECT  
BEST  
MODEL

1 WEEK LATER



## TEACHING MOMENT

AutoML isn't just faster—it has the potential to also be more fair because it looks for patterns without the same biases humans might include.

While the model now makes fair predictions, it is eventually up to us humans to decide whether to accept the prediction or not. If we do not accept or believe the prediction, the fair suggestions will not be taken into consideration.

