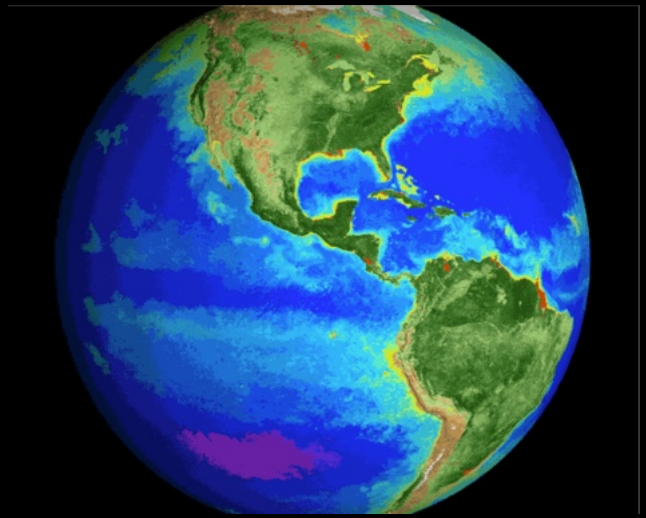
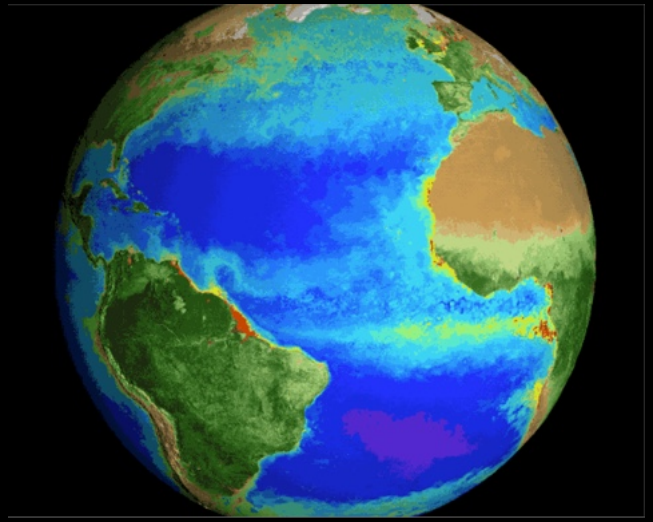
Bigelow | Laboratory for Ocean Sciences

Data Justice and Algorithm Accountability in Ocean Forecasting

Nick Record

Algorithms in the Wild





Algorithms in the Wild

- Real-time monitoring
- Real-time calculations & analysis
- Data aggregation (web crawling, etc.)
- Dynamic closures, speed reductions
- Stock assessments & quotas
- Sorting & disseminating scientific knowledge
- …

Algorithms in the Wild

→ Increasingly automated

→ Increasingly “intelligent”

→ Increasingly replacing human decision making

Ocean Data Justice & Algorithm Accountability

Data Justice Concepts

- Algorithmic Accountability*
  - Method for holding an algorithm to an ethical standard determined by domain experts

*Matthews et al. 2020, Grasso et al. 2020

Data Justice Concepts

- Algorithmic Accountability
  - Method for holding an algorithm to an ethical standard determined by domain experts
  - **Relevance to Oceans**: Algorithms replacing humans in decision making
    - Veneer of objectivity, but magnify bias, contain confirmation bias
    - Real-time monitoring, stock assessments, search engines, data analysis pipelines, statistical methods

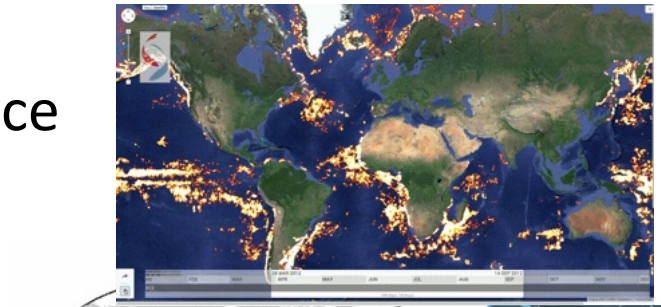
Data Justice Concepts

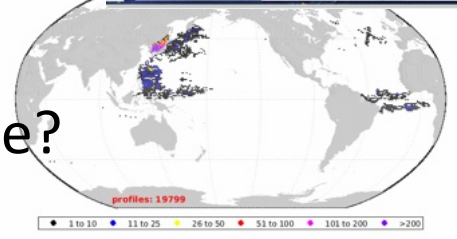
- Surveillant Assemblage*
  - A convergence of surveillance systems that reassemble ‘data doubles’

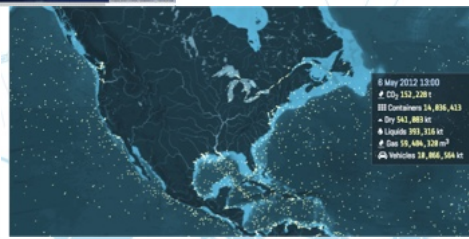
*Haggerty & Ericson 2000

Data Justice Concepts

- Surveillant Assemblage
  - A convergence of surveillance systems that reassemble ‘data doubles’
  - **Relevance to Oceans**
    - Environmental surveillance
    - Ecological ‘data doubles’ inform policy
    - Who gets to see data?
    - What data is in the double?







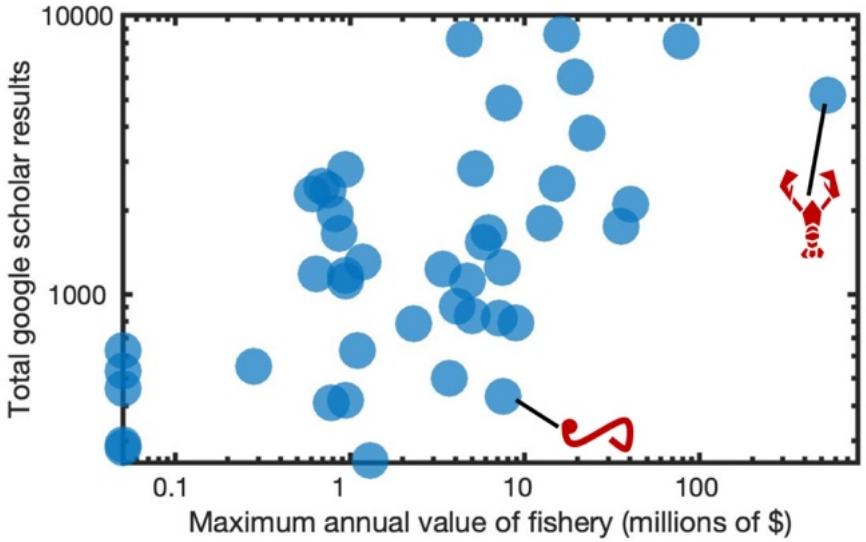
Data Justice Concepts

- Extractive Logic*
  - Disconnect data from its context
    →Capital

*Vera et al. 2019

Data Justice Concepts

- Extractive Logic
  - Disconnect data from its context
    → Capital
  - **Relevance**
    - "Ecosystem services" lens
    - Fishing down food webs (Pauly)
    - "Parachute science"

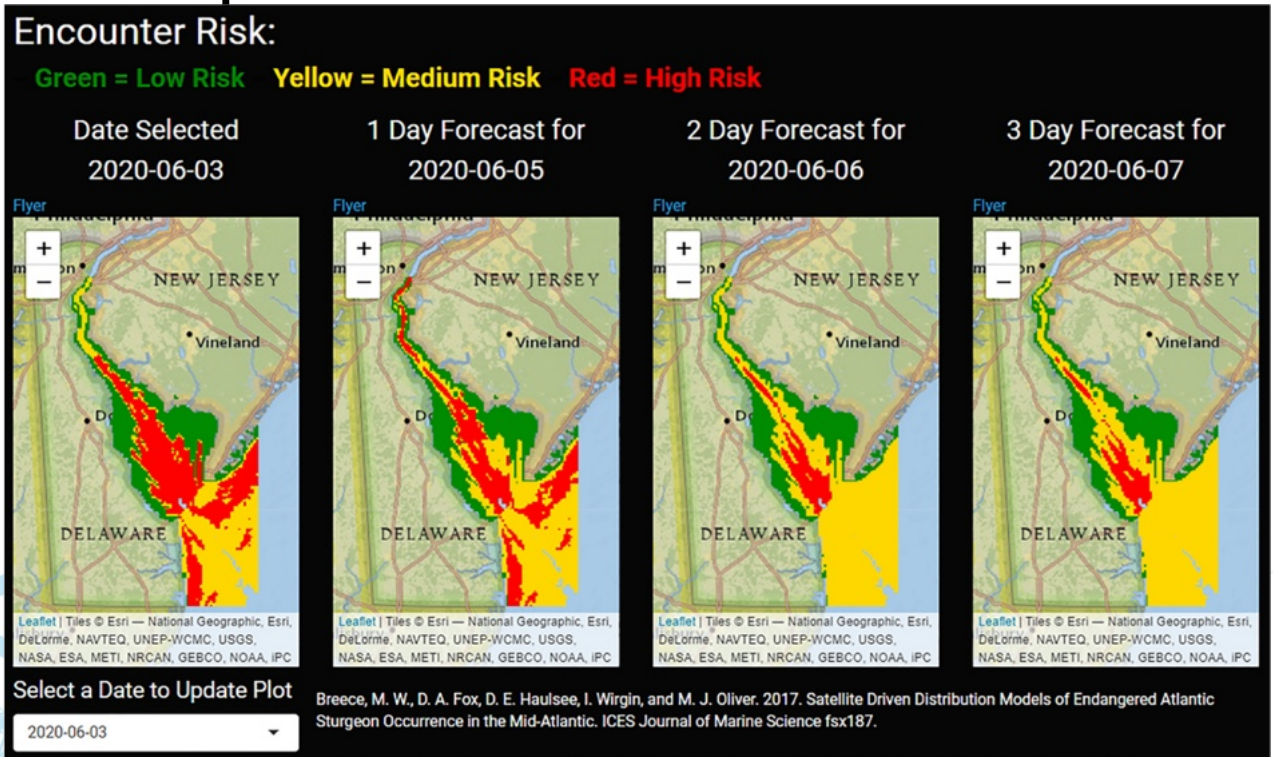


Record & Vera 2021

Lessons for Forecasting

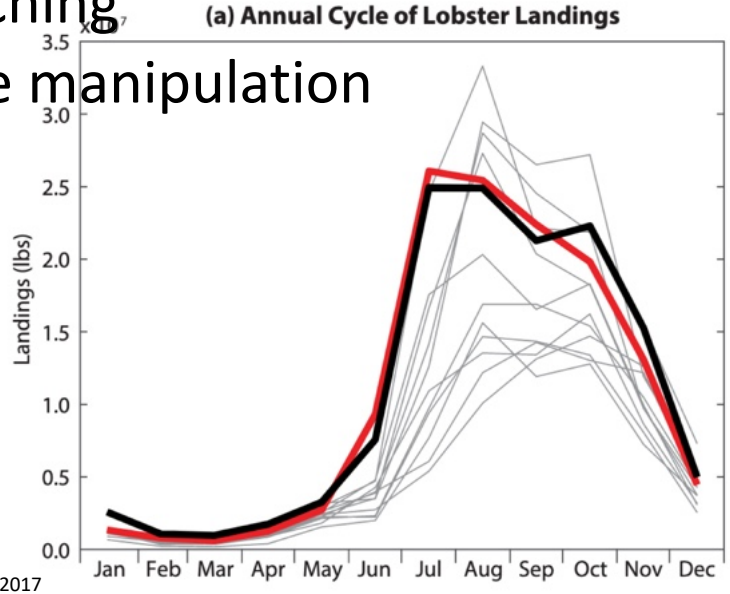
Is it always better to have the forecast?

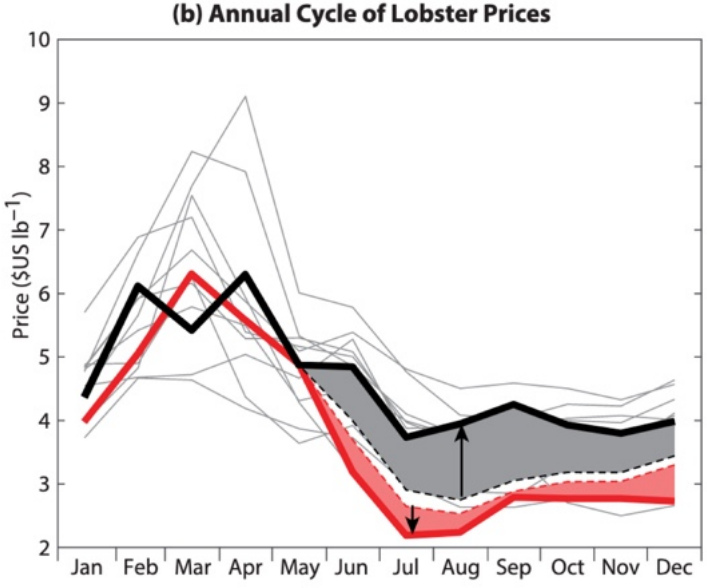
- Unintended consequences
  - Examples:
    - Poaching



Is it always better to have the forecast?

- Unintended consequences
  - Examples:
    - Poaching
    - Price manipulation

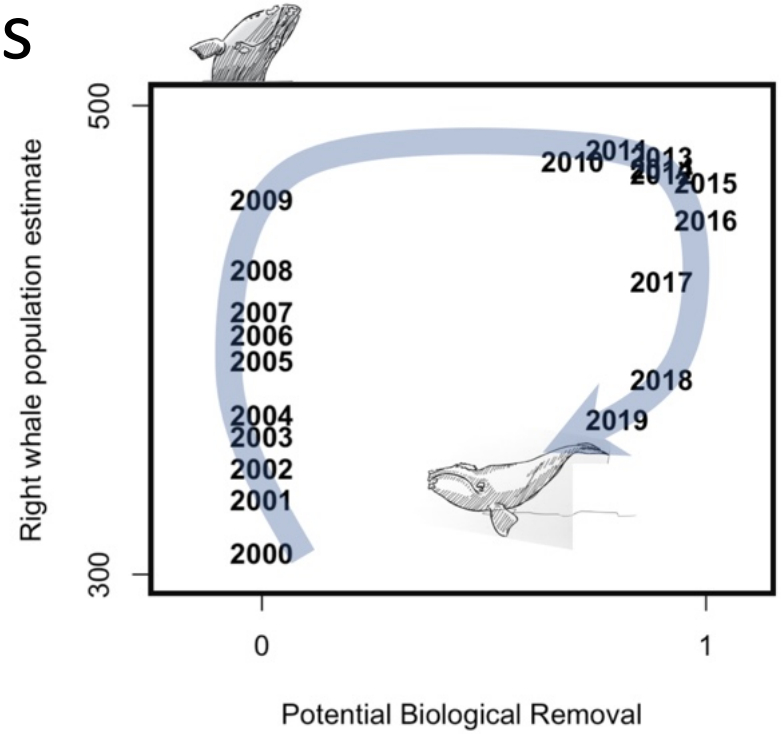




Mills 2017

Is it always better to have the forecast?

- Unintended consequences
  - Examples:
    - Poaching
    - Price manipulation
    - Reflexivity



Record 2021

Is it always better to have the forecast?

- Unintended consequences
  - Hobday 2019

Table 2. Ethical issues encountered in the scoping, development, delivery, and evaluation phases of ecological forecasts for marine resources across seven case studies in three domains (X) as described in Table 1.

Example (and domain)	Scoping		Development		Delivery					Evaluation
	Conflicts of interest	Ecosystem health	Skill assessment (inadequate)	Representation of uncertainty (inadequate)	Delivery of products	Engagement and education	Delivery failure	Equity for users	Unintended consequences	Review of performance of the whole system
1. Tasmanian salmon (aquaculture)					X	X	X	X	CC?	
2. Eastern Australia dolphinfish (fisheries)		X		X						X
3. Great Australia Bight tuna (fisheries)						X			X	
4. Maine lobster (fisheries)						X		X	X	X
5. Northwest Atlantic fishers (fisheries)	X	X	X	X				X	X	
6. Northeast Pacific environments (fisheries)				X	X		X			
7. Delaware Bay sturgeon (conservation)	X		X	X	X		X			

Other issues may have been possible, but were not evident due to circumstance or practise.

What is “societal benefit”?

- Who benefits?
- How does that benefit affect power (im)balances?
- Implication for climate adaptation

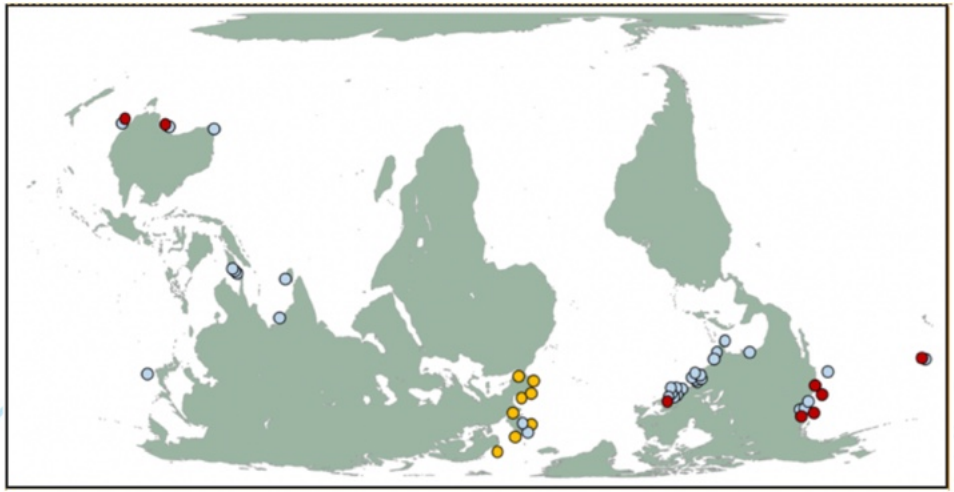


Figure 1 Global distribution of operational ecological ocean forecasting systems estimated from three recent reviews: Payne et al. 2017 (red); Record & Pershing 2021 (blue); Fernandes-Salvador et al. 2021 (yellow).

Forecasting is valuable

- Weather forecasting

  $300 billion globally (NERACOOS, Spinrad 2013)

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  Probably bigger than that

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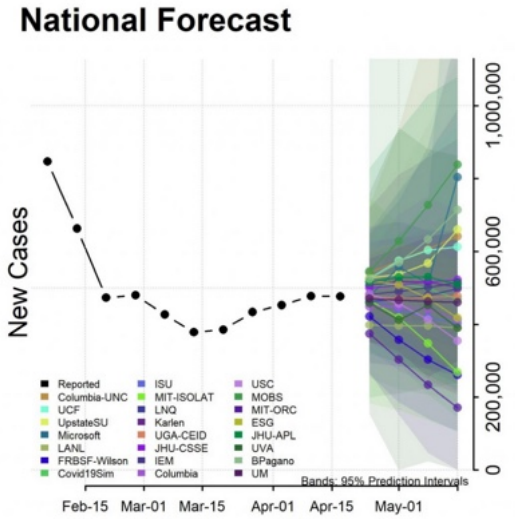
- Weather forecasting
  $300 billion globally (NERACOOS, Spinrad 2013)
- Financial forecasting
  Probably bigger than that
- Many new forecasts
  COVID, etc…

--> Climate adaptation



Forecasting is valuable

- What is the $$ value of **ocean forecasting**?

- Who gets that value?

References

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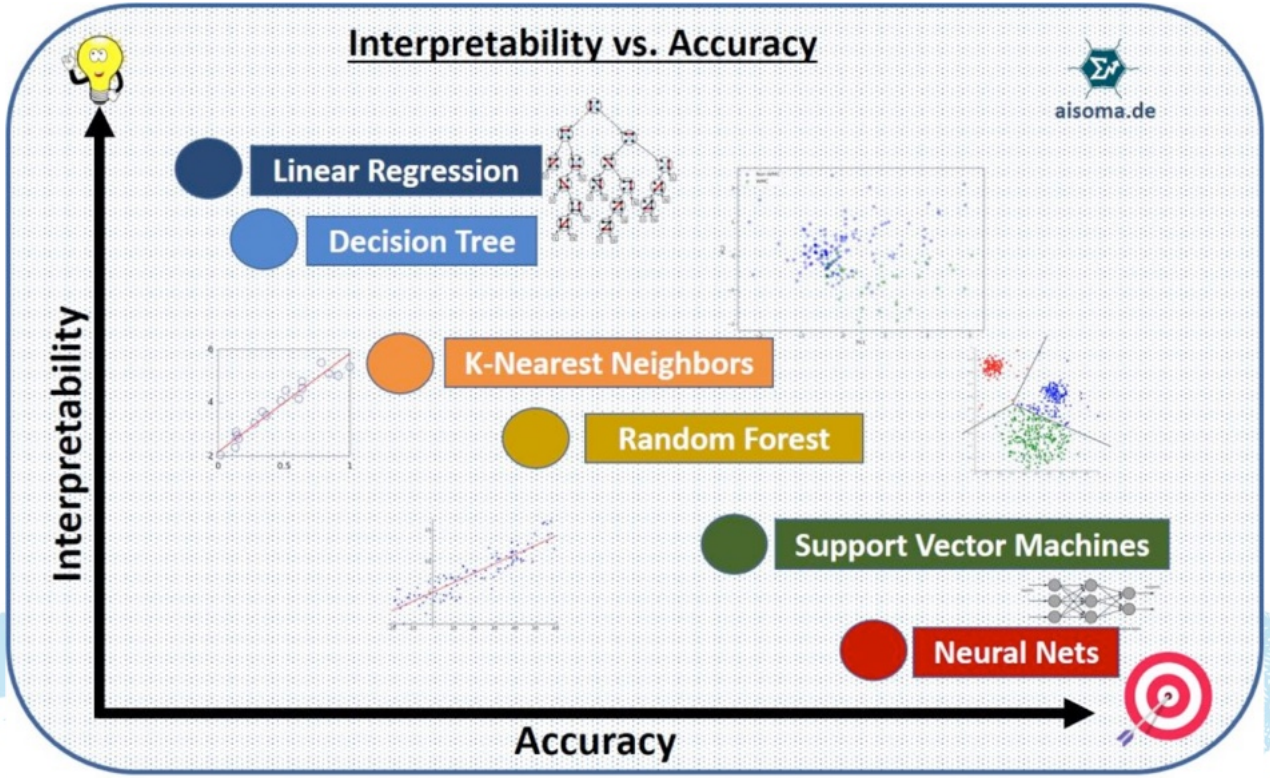
Machine Learning Algorithms

Machine Learning Algorithms

- 

Machine Learning Algorithms

- Regression

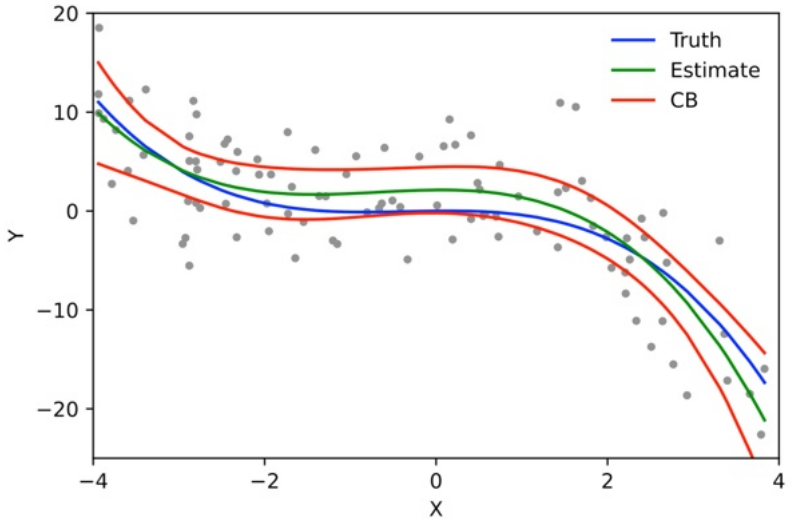
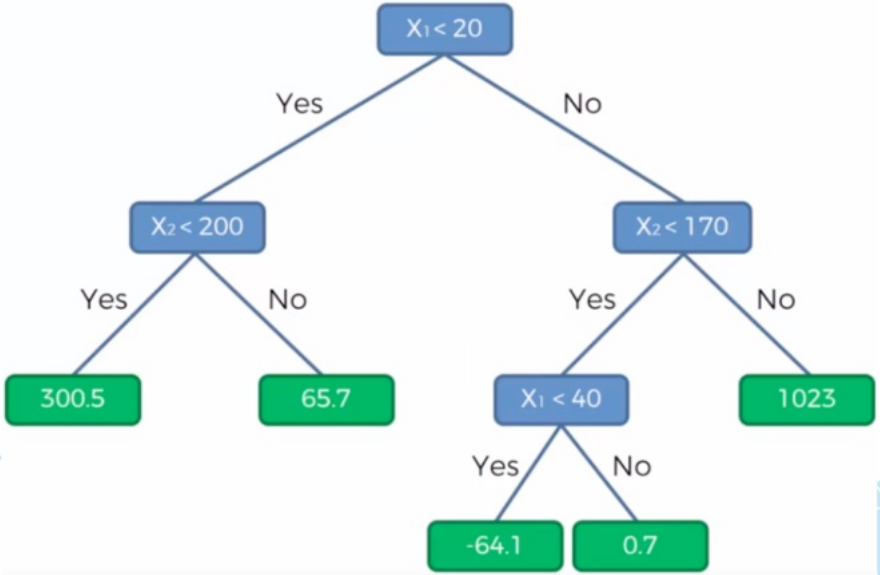


Image: wiki commons

Machine Learning Algorithms

- Decision Tree



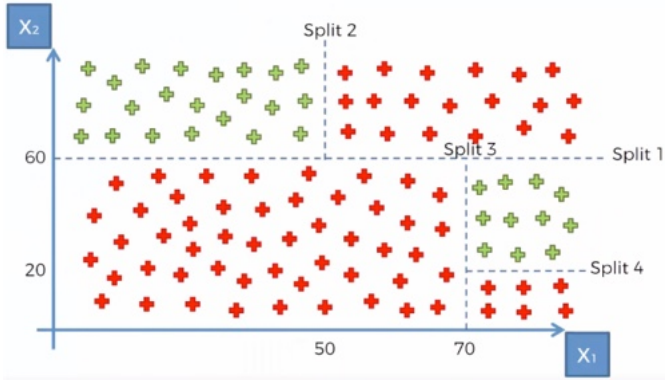


Image: https://medium.com/pursuitnotes/decision-tree-regression-in-6-steps-with-python-1a1c5aa2ee16

Machine Learning Algorithms

- Random forest

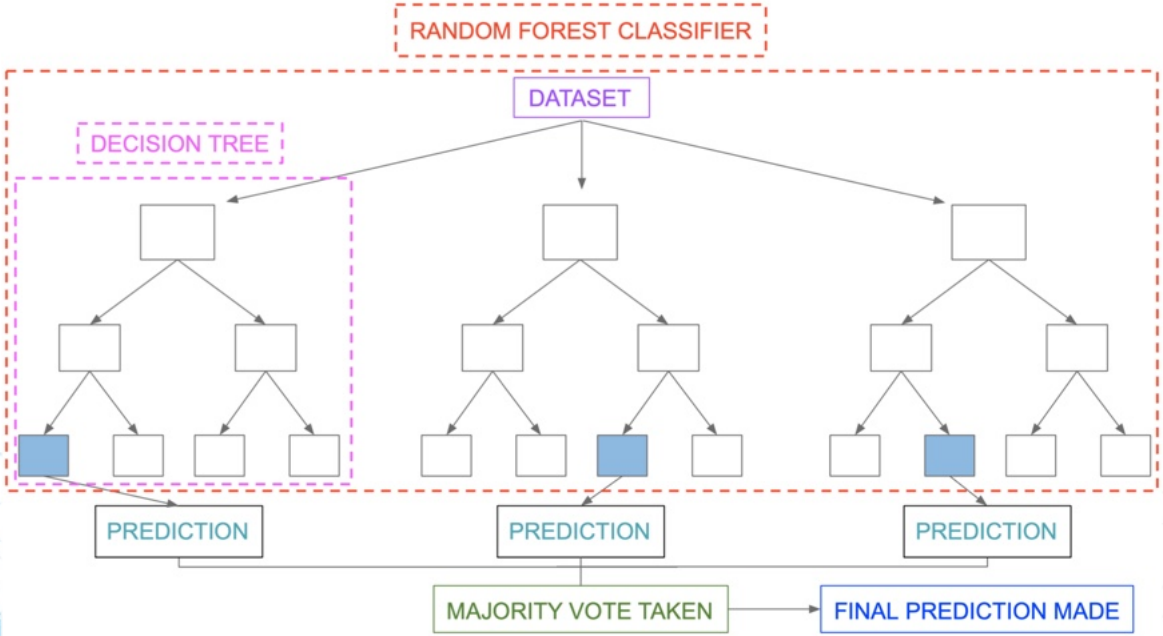
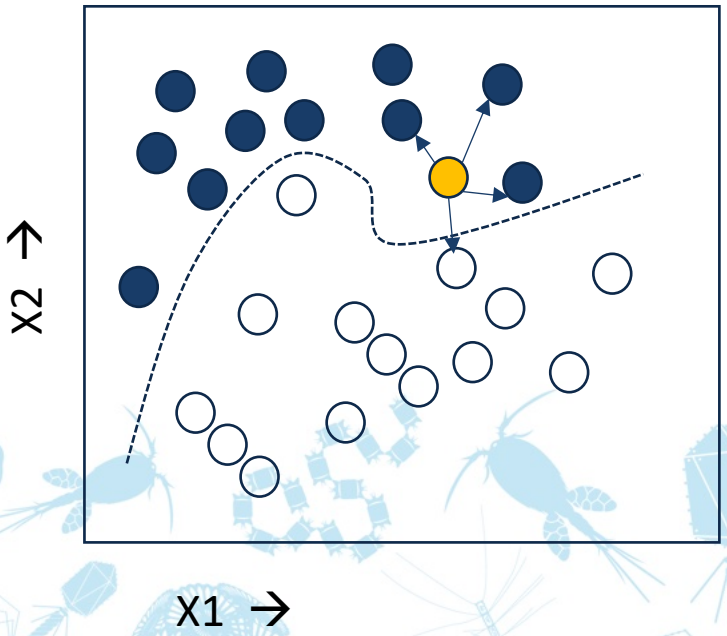


Image: https://miro.medium.com/max/5752/1*5dq_1hnqkboZTcKFfwbO9A.png

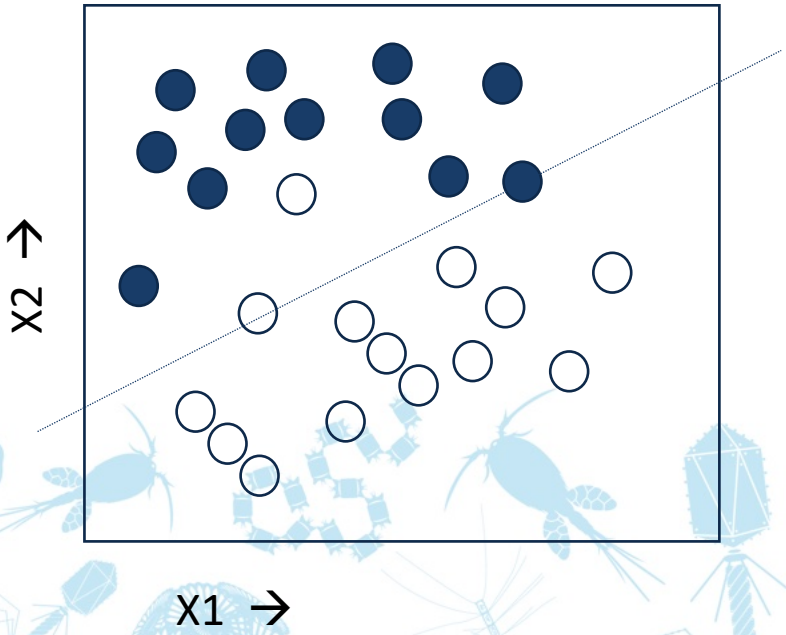
Machine Learning Algorithms

- K – nearest neighbors



Machine Learning Algorithms

- Support Vector Machine



Machine Learning Algorithms

- Neural Network