Prediction: Week 9

"NASA: Supercomputing the Climate" (intro)

Where are we? (logistics)

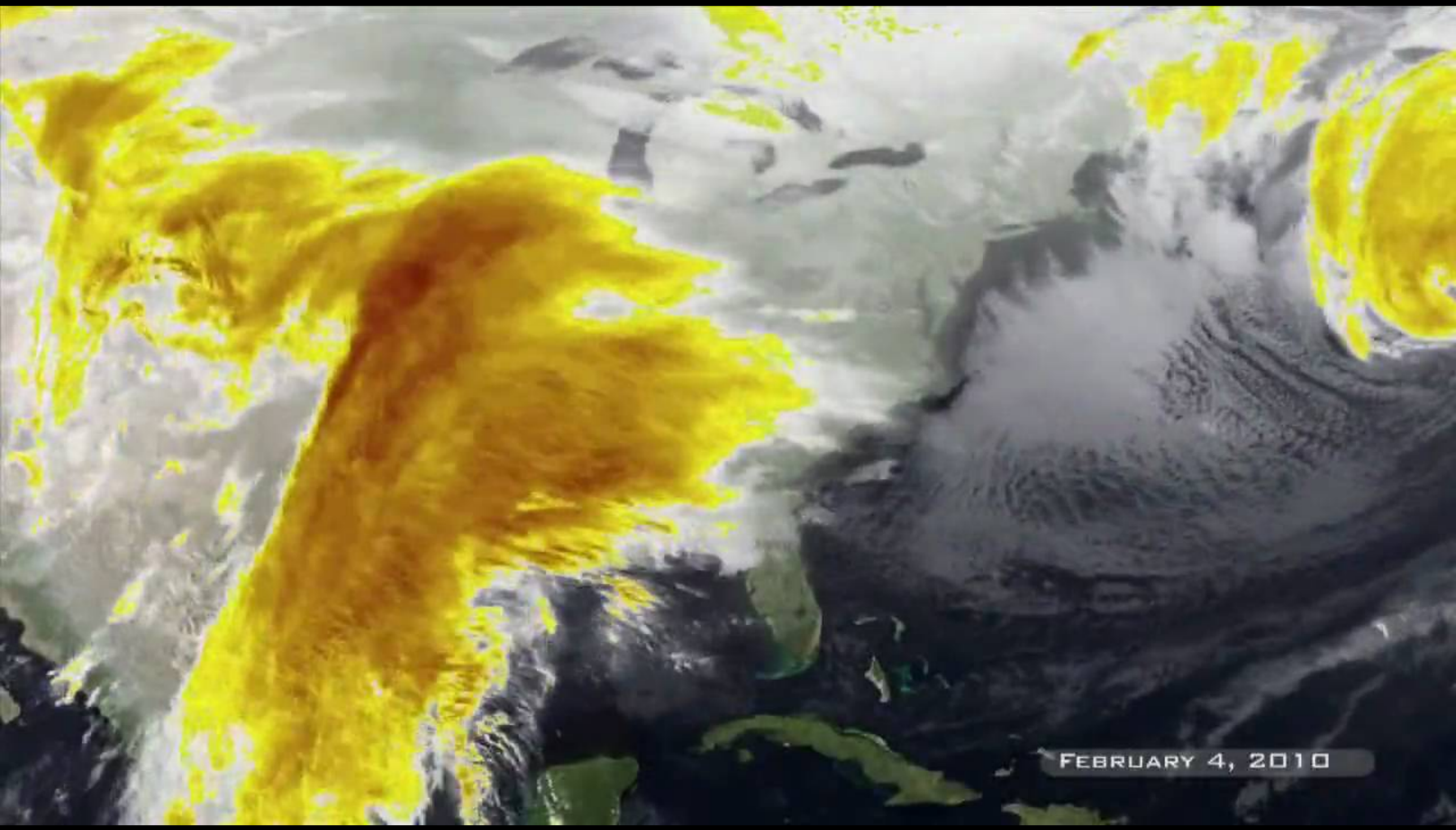
"Models:" Mental, STATISTICAL, SIMULATION, and Physical

How are models used to make Modern Predictions?

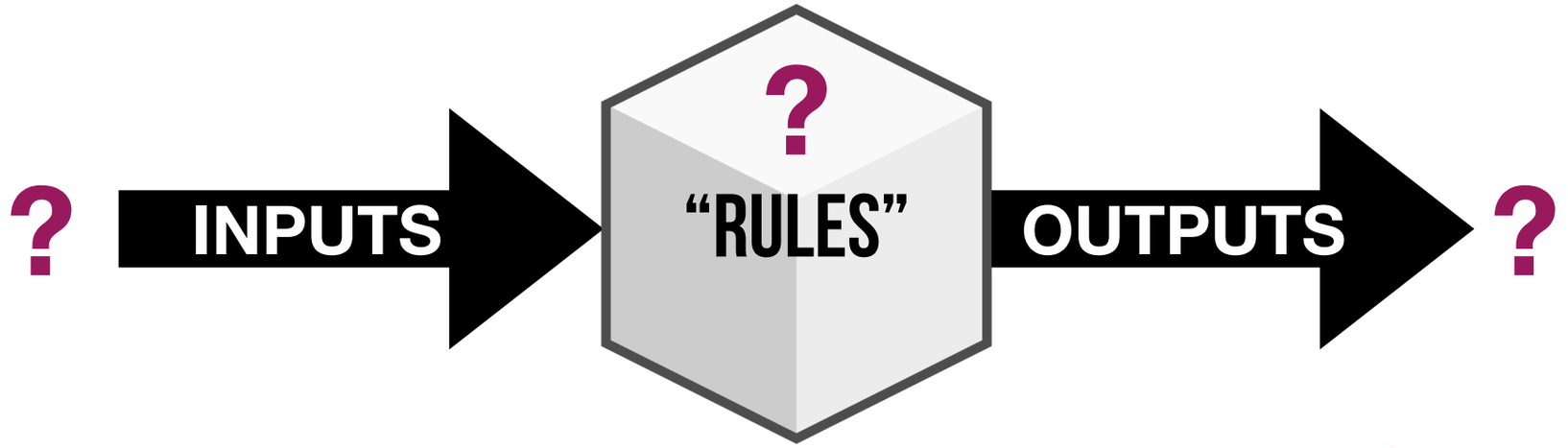
[see revised plan below]

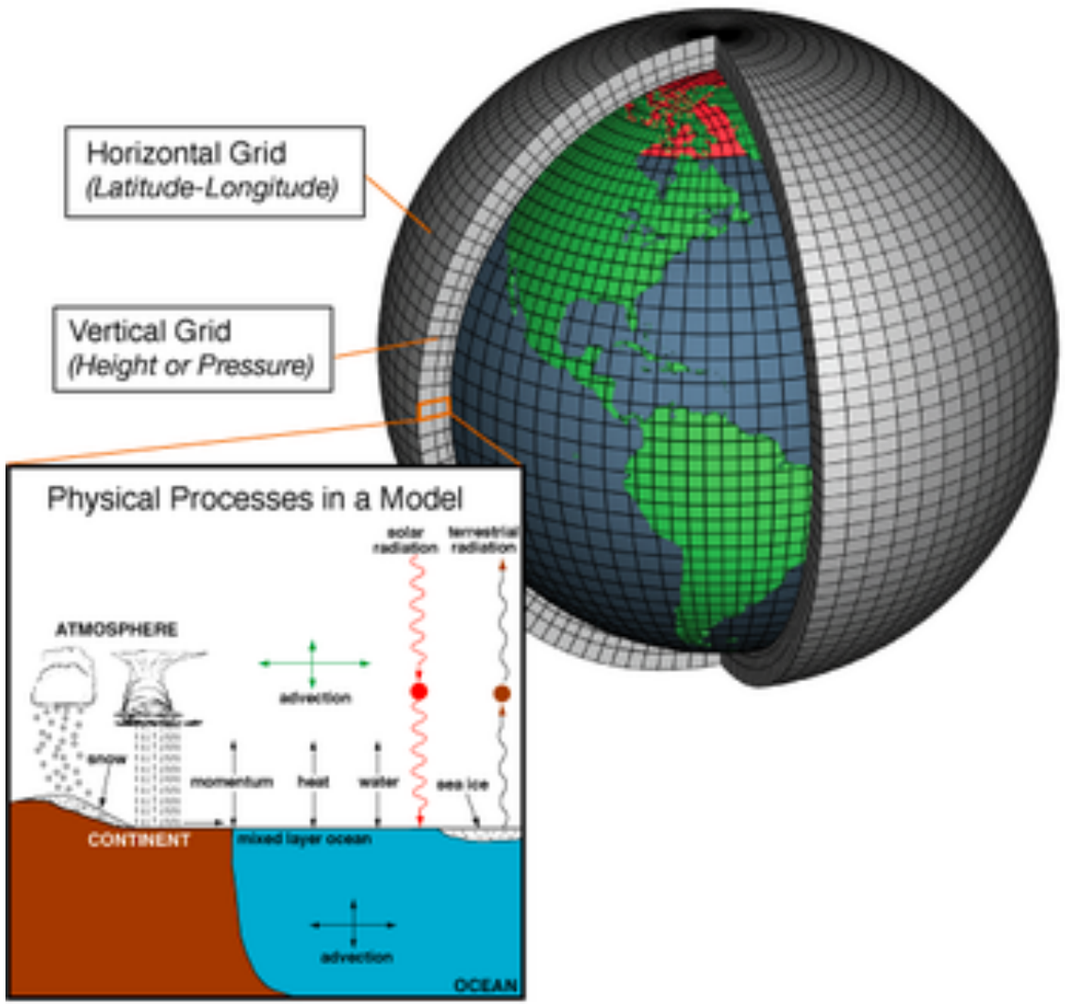
Weather/Climate *simulating* spatial processes	Systems Biology *simulating* non-spatial processes	Genomics *statistical* predictions of physical traits	Mobile Health *statistical* predictions of behavior

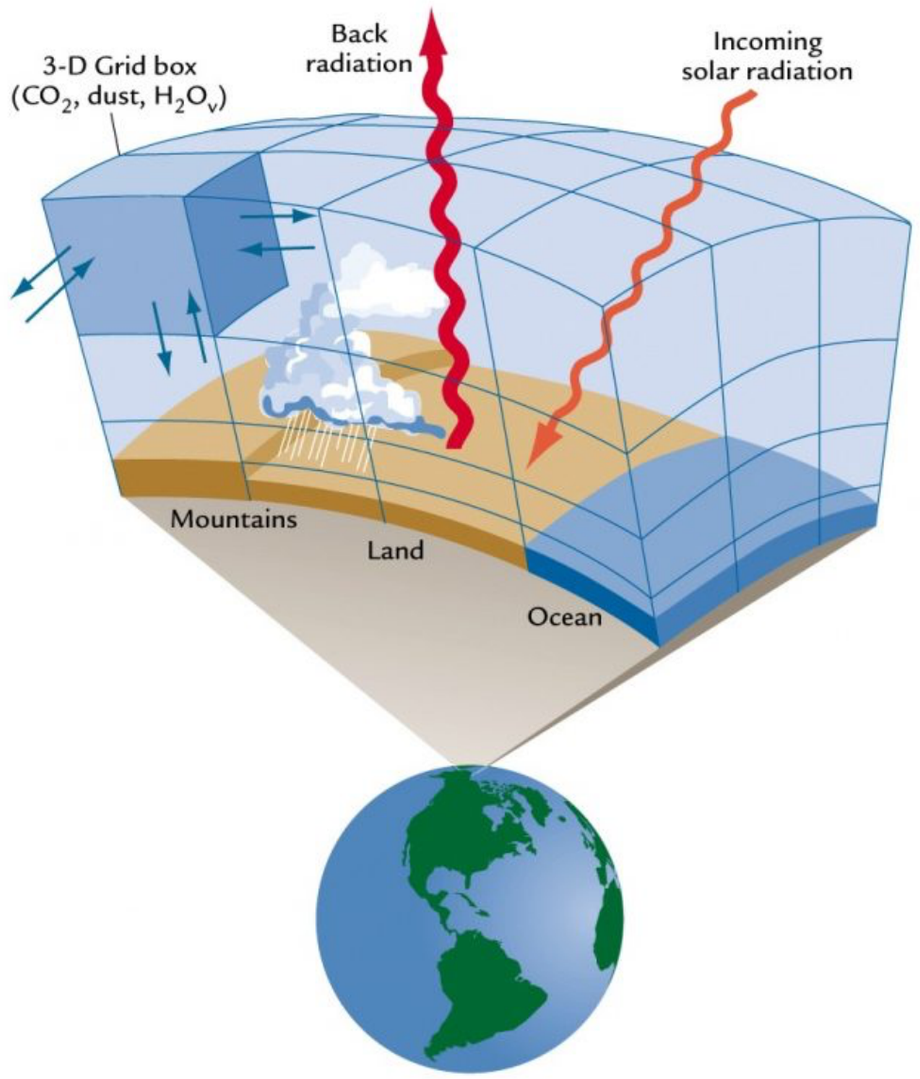
“Supercomputing the Climate”



https://www.youtube.com/watch?v=jj0WsQYtT7M







Credit: www.viaenglish.com/blog/en/how-weather-models-predict-the-future/

What measured inputs are important to numerical simulations of weather?

Top

What "rules" (e.g. physical and/or chemical principles) are used in numerical simulations of weather?

Top

What are the key outputs of weather prediction?

Top

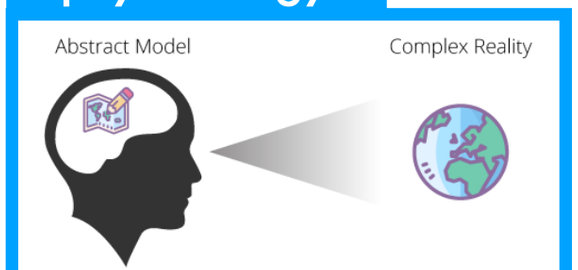
Modern Prediction: Where are we?

Week	Topic	Date		Date	Assignments
8	Intro to Modern Simulatio		Where does	Weather & Climate:	, Rebecca
9	Modelin				us one of: urch, r Kraft
10	The Futur Wealth Health				(by 4/6)
11	The Futur the Unive				4/13)
12	Artificia Intelligenc Bayesia Thinking				urphy (by 4/ 20)
12a	The Future of the Future	4-27	Final Discussions + featured student videos	4-29	Stuart Firestein, Agustin Rayo (optional) (by 4/27)

REVISED—see version below

“Models:” Mental, **STATISTICAL**, **SIMULATION**, and Physical

concerning cognition, psychology



INPUTS

PREDICTIVE SYSTEM

OUTPUTS

building a real object, in the real world

“HUMAN”

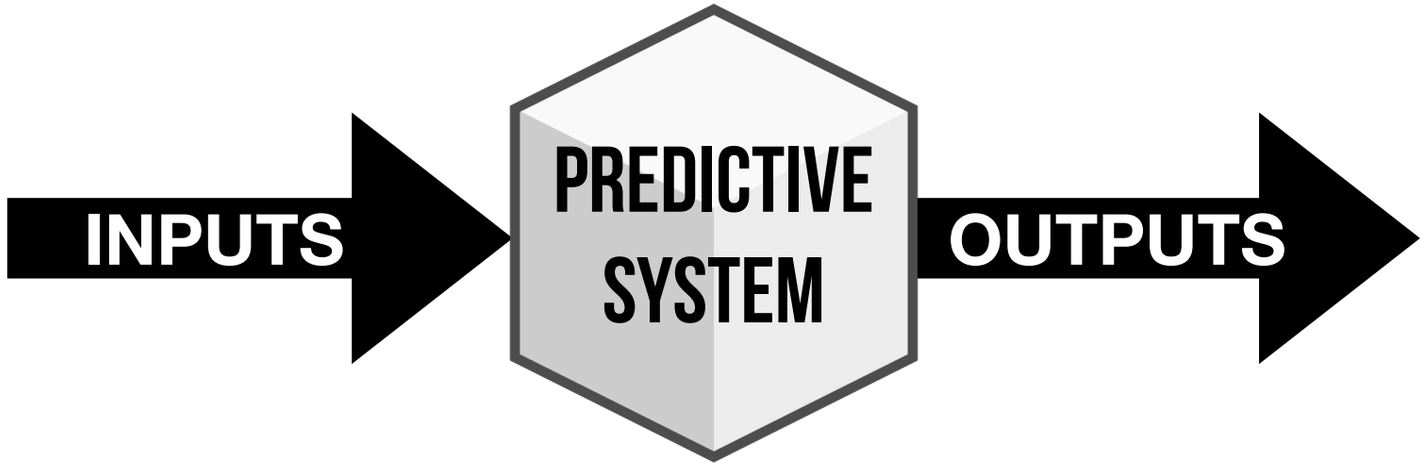
STATISTICAL

SIMULATION

COMBINATIONS

Image credits: gohighbrow.com/mental-models/, https://www.bbc.com/news/av/health-30996506/3d-printed-heart-helps-to-save-girl-s-life

"Models:" Mental, **STATISTICAL**, **SIMULATION**, and Physical



"HUMAN"

STATISTICAL

SIMULATION

COMBINATIONS

Only "SIMULATIONS" can have truly deterministic rules (but not all do)

om/mental-models/, https://www.bbc.com/news/av/health-30996506/3d-printed-heart-helps-to-save-girl-s-life

Remember to always ask…

"Simulation" or "Numerical Experiment"?

- Simulation: goal is reality
- Numerical Experiment: A "what if" question, about one parameter or idea.

What to do about critical inputs you can't have?

- e.g. underground activity in earthquake forecasting, true # of COVID-19 infections, aspects of human behavior?

Is a more complicated system always better?

- recall Marianna Linz' simple global temperature model…
- SimCity 2000 vs. The Sims…

Fine points & questions for future discussions

These “tags" will all make sense to you by the end of our course… (see annotations in LabXchange videos)

Prediction X: Modern Simulations--THEMES/TAGS

#simulation_or_model (c.f. list)
#theoretical_empirical (c.f. Rainbow diagram)
#framework_model_inputs (c.f. document)
#framework_testing (c.f. document)
#biases (c.f. document)
#uncertainty (c.f. document, puck simulation (link), Take a Sweater)
#approximation (c.f. Ten questions) #Heuristic
#public_reaction (c.f. document)
#predictability
(predictability, determinism, randomness and uncertainty--use sand on shuffleboard analogy, includes #convergence, #divergence, #feedback #chaos)
#unkown_unknowns
#bayes_theorem
#deterministic_vs_probabilistic (probabilistic vs. deterministic prediction...when is uncertainty small enough to call it “deterministic”?)
#machine_learning (c.f. list)
#artificial_intelligence(c.f. list, Derek’s Day)
#prediction_vs_decision
#explanation_vs_prediction (c.f. rainbow diagram)
#technology_theoretical_computation_and_math (c.f. list)
#technology_observational_experimental_devices_and_sensors (c.f. PtN)
#future_of_the_future
#personal_or_societal
#samplesize
#resolution
#rainbow_diagram

This “week,” let’s try for…

#technology_theoretical_computation_and_math

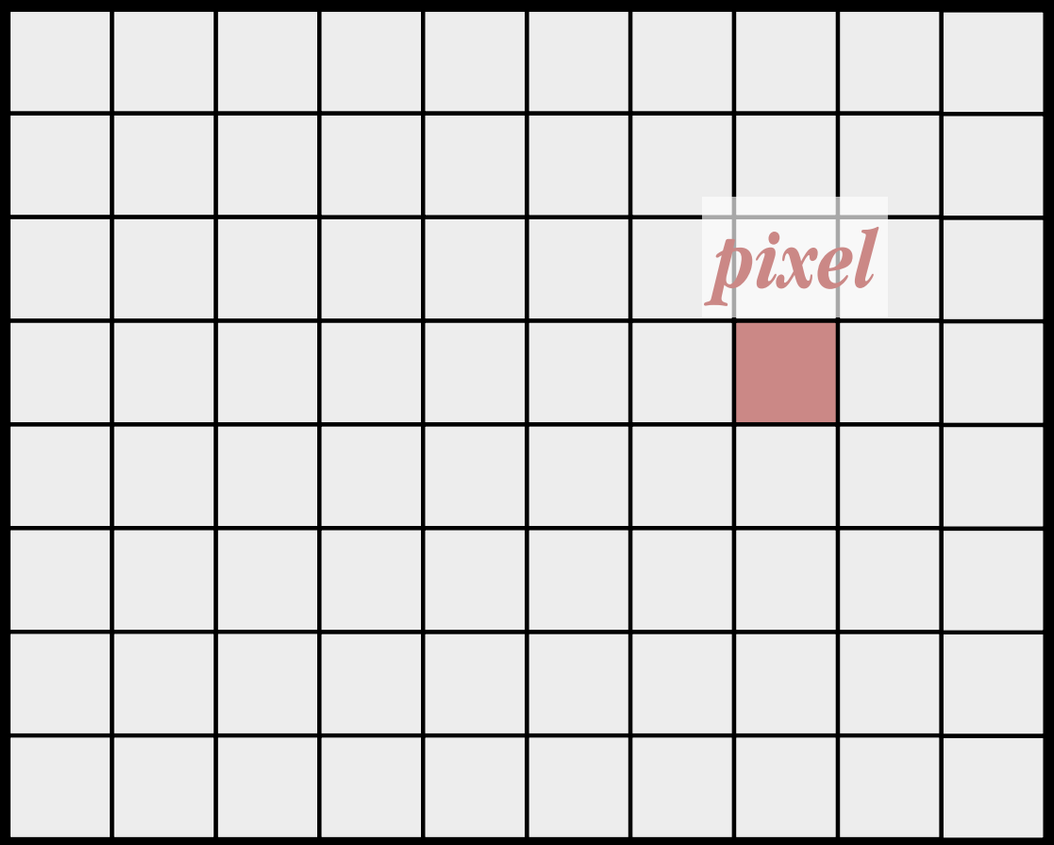
#simulation_or_model #rainbow_diagram

#resolution #samplesize #uncertainty #approximation

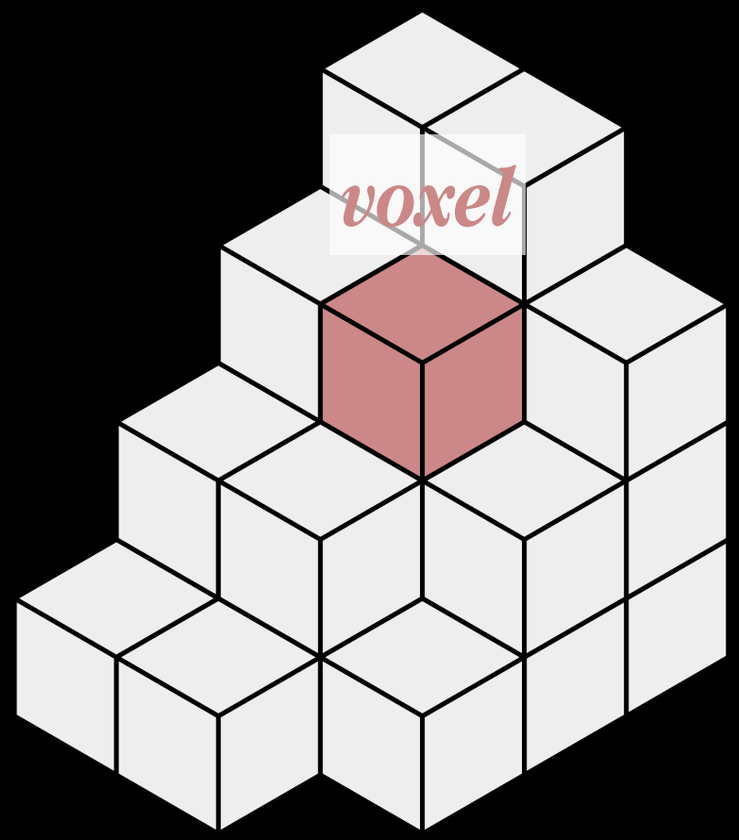
#divergence #convergence

#deterministic_vs_probabilistic

2D computational zones are called “pixels” or “grid cells”

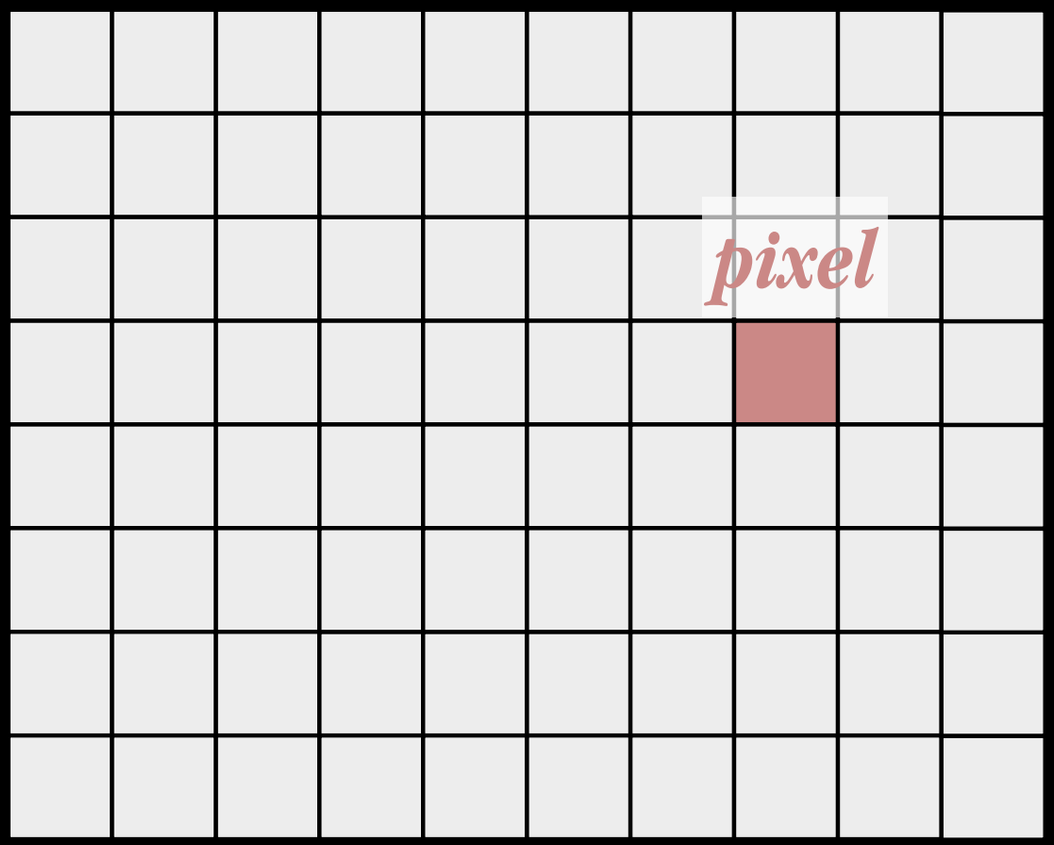


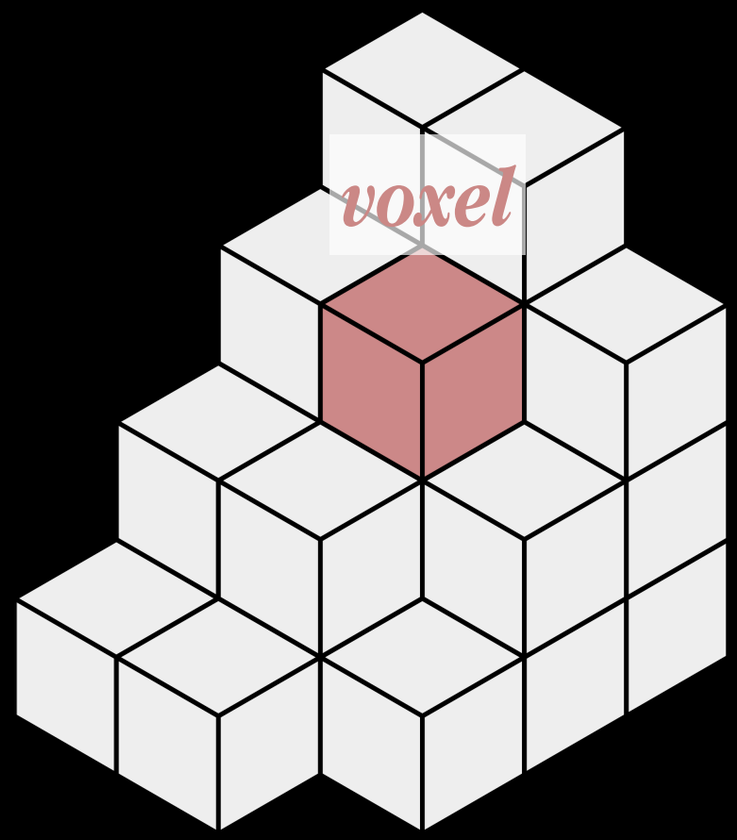
3D computational zones are called “voxels” or “grid cells”



#resolution #simulation_or_model #technology_theoretical_computation_and_math

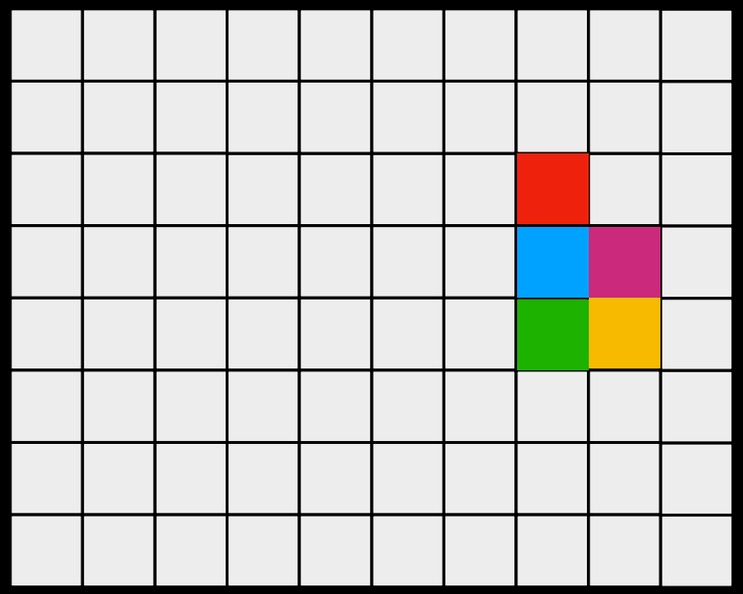
The rules applied in a simulation give an “update” for what happens in each “pixel” or “voxel” depending on what happens in neighboring cells.





The resolution in any simulation cannot be finer, in space, than the size of the smallest grid cell, or in time than the smallest time step.

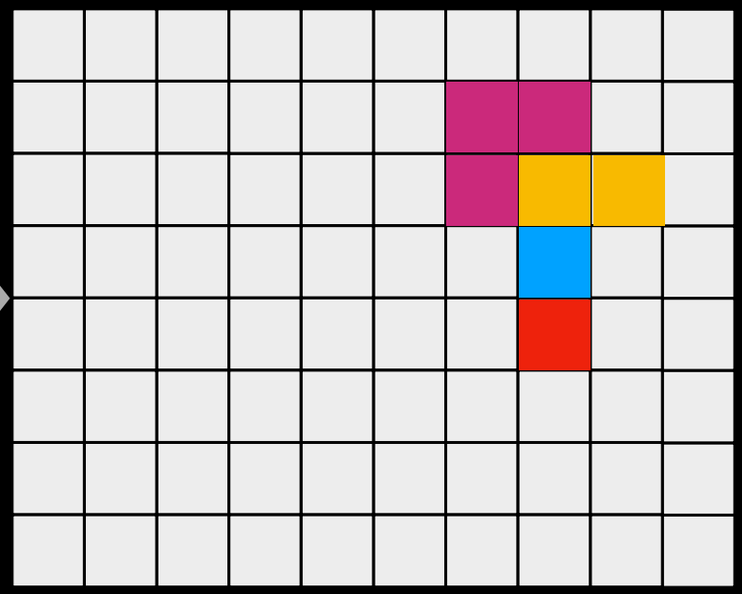
“Time Step n”



System is in some “state” shown by the arrangement of colors in the pixels

PREDICTIVE SYSTEM

“Time Step n+1”



System is in new “state” shown by the new arrangement of colors in the pixels

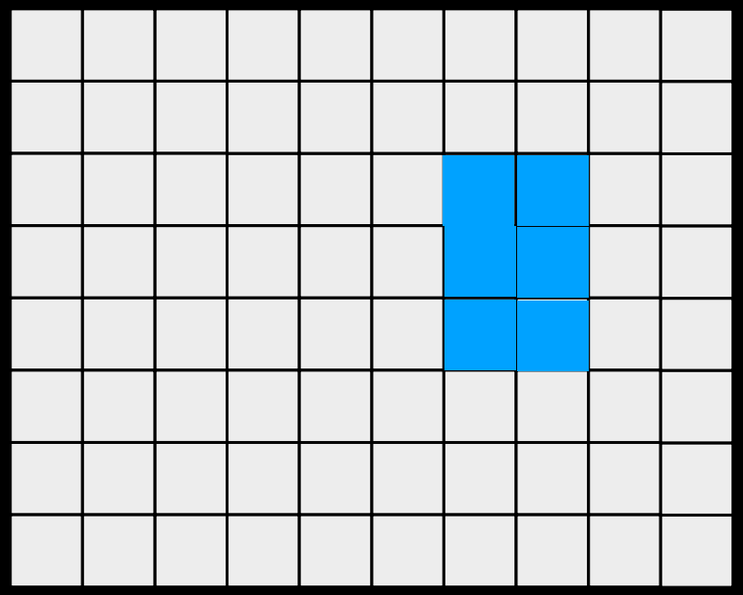
The resolution in any simulation cannot be finer, in space, than the size of the smallest grid cell, or in time than the smallest time step.

INPUTS

PREDICTIVE SYSTEM

OUTPUTS

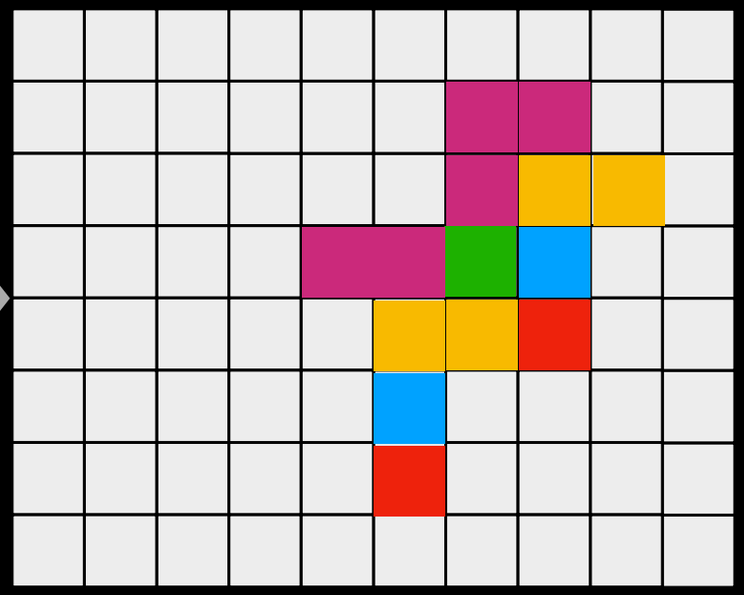
Initial Conditions



This starting state is determined by **INPUTS** to the predictive system.

after total # of steps…

Final Conditions



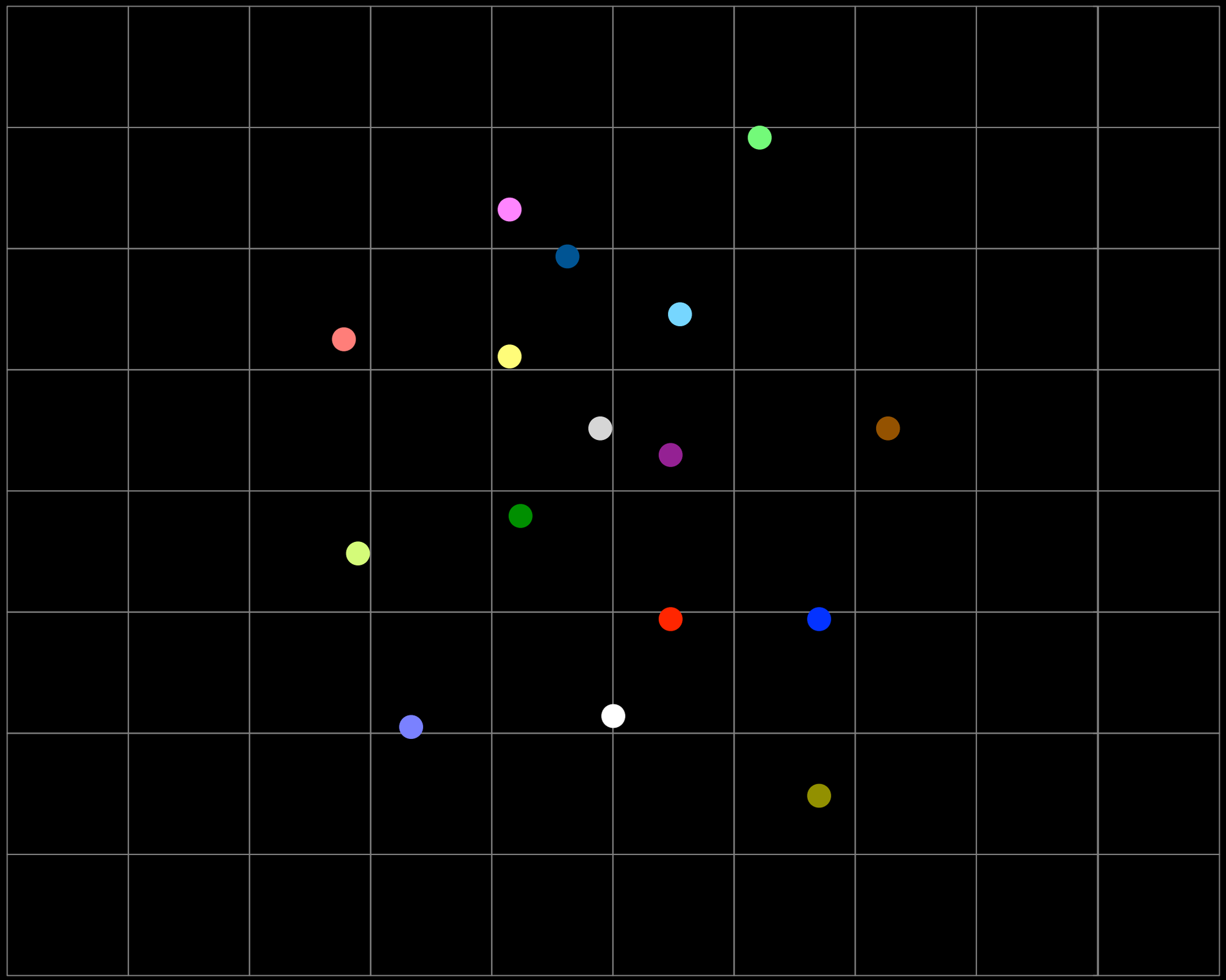
At the last time step, the state of the simulation is the **OUTPUT**.

The resolution in any simulation cannot be finer, in space, than the size of the smallest grid cell, or in time than the smallest time step.

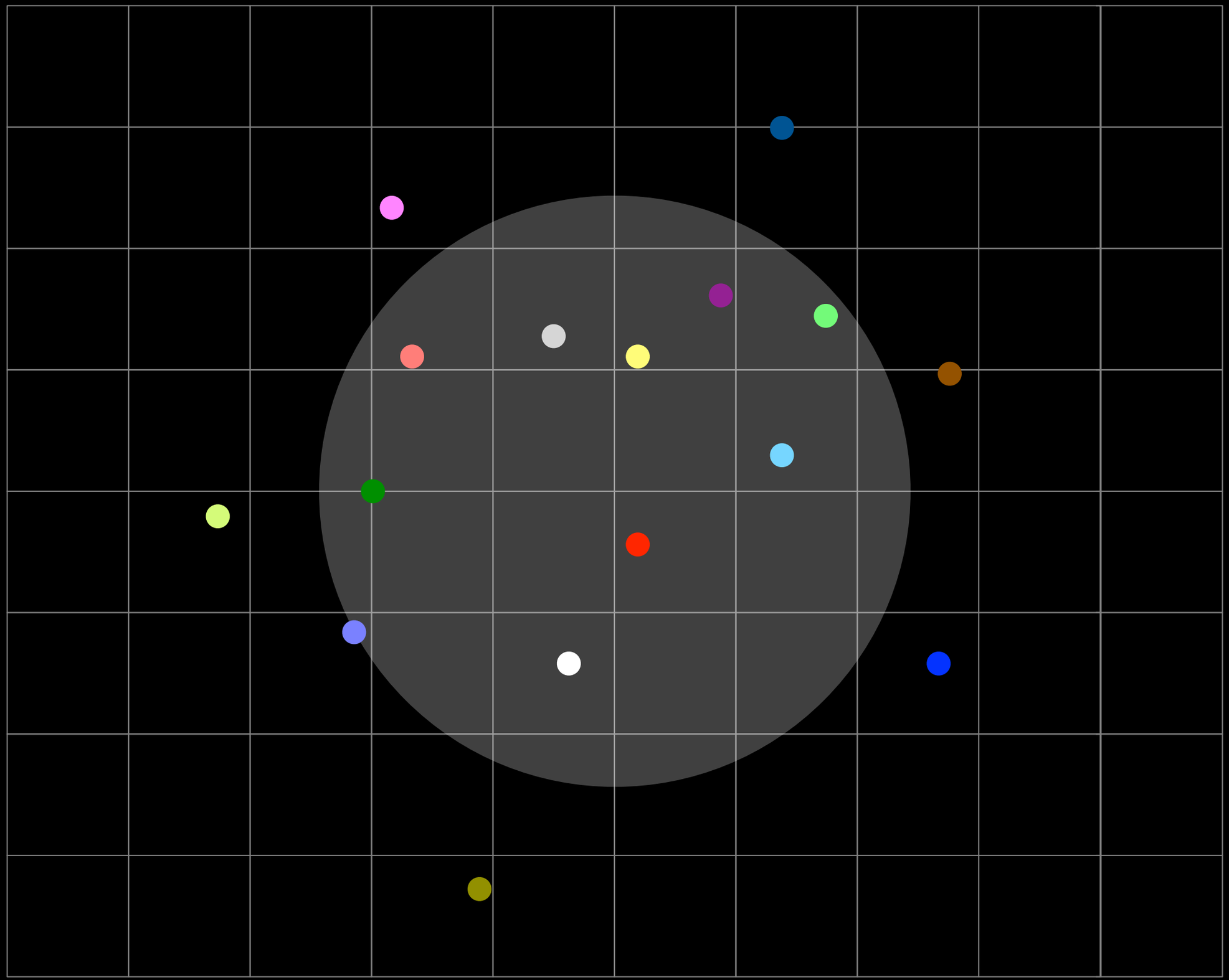
How are models used to make Modern Predictions?

Simulation of “Random” Particle Motions

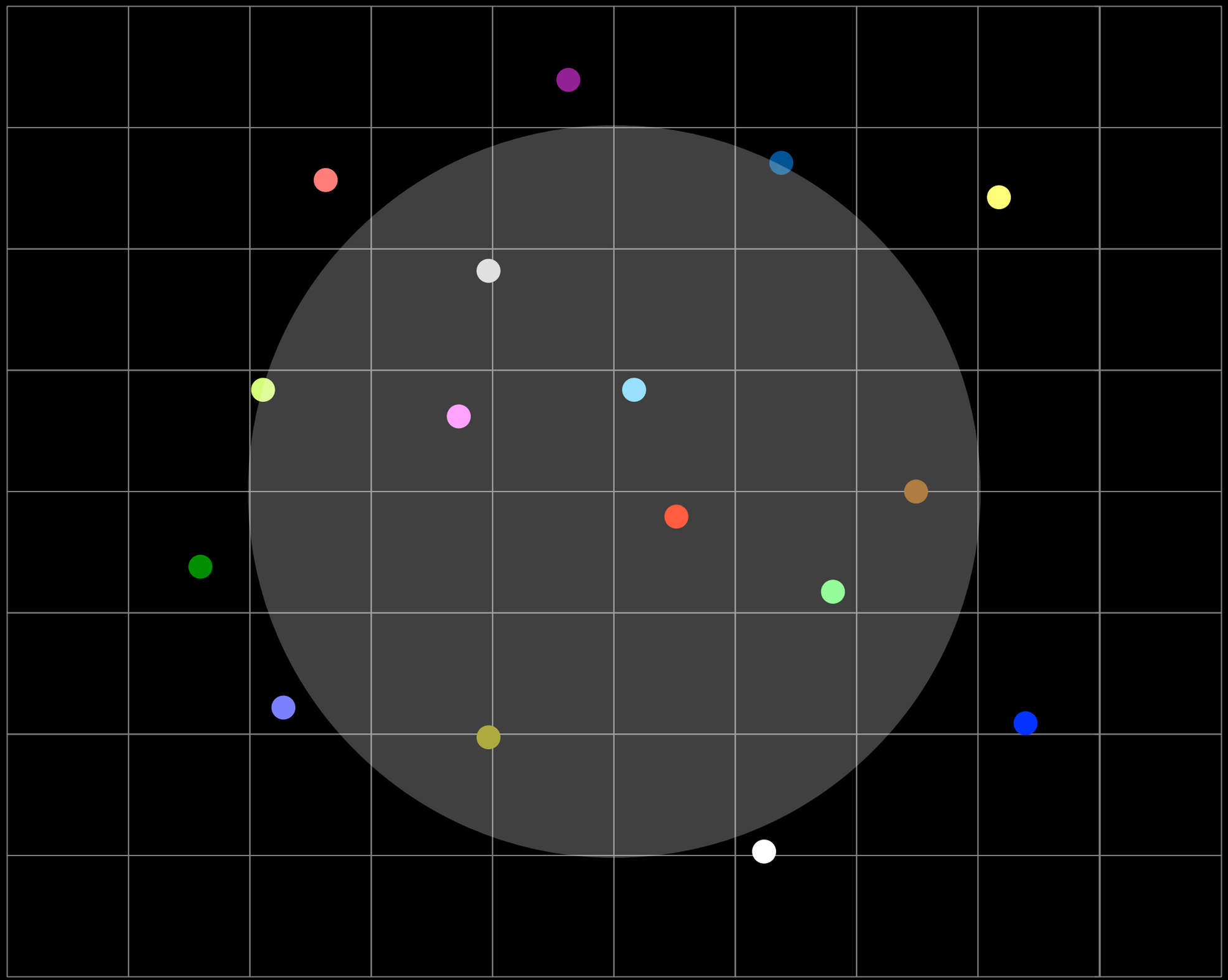
Each particle moves within a range of speeds, in a random direction, at each time step.



With these rules, we can predict the “expected” area of the particles’ distribution.



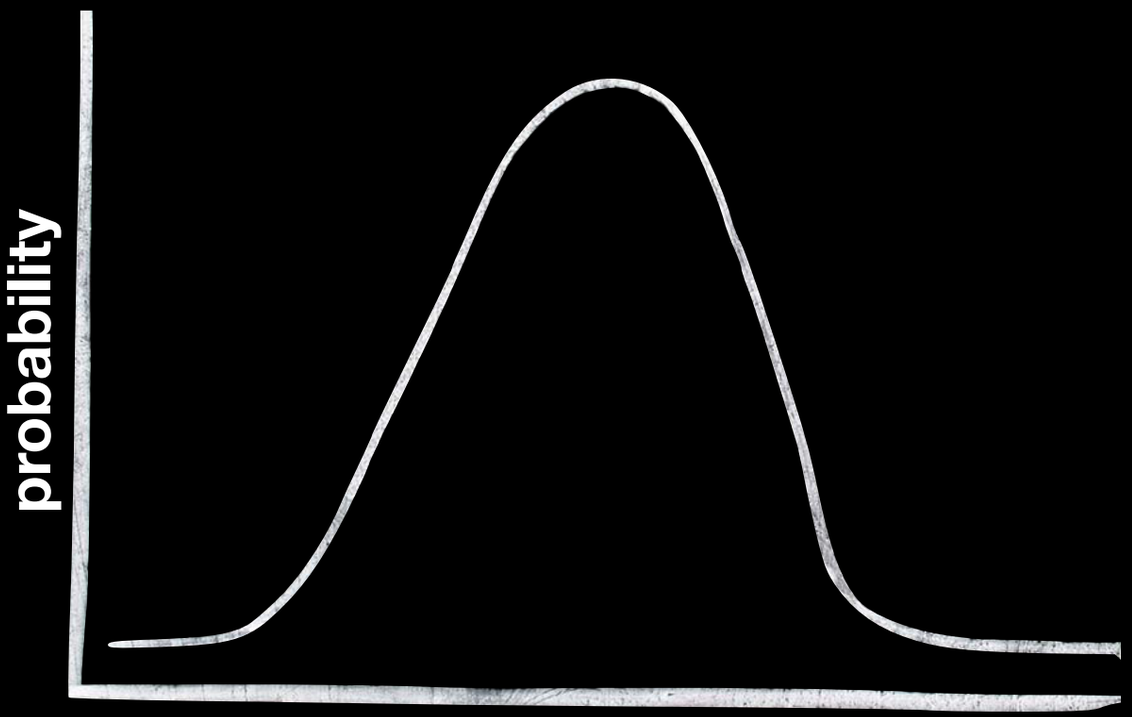
…and how it should grow with time



PREDICTIVE SYSTEM

[THE RULES]

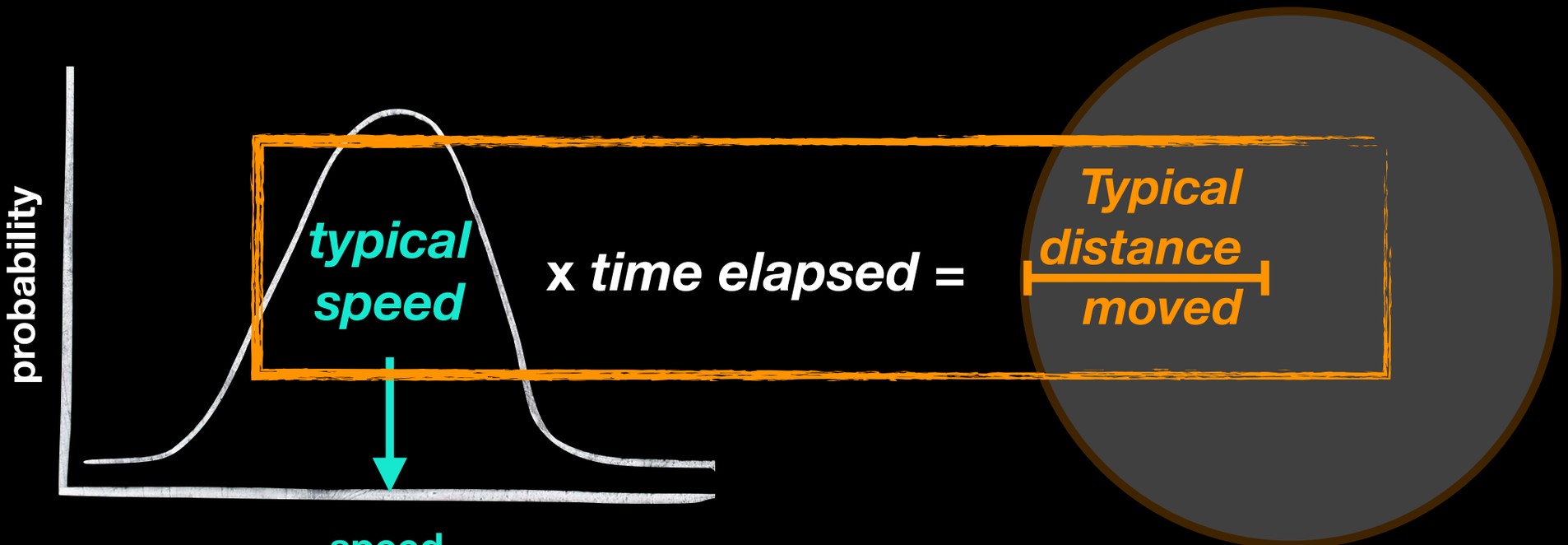
“Each particle moves within a range of speeds, in a random direction, at each time step.”



speed

direction

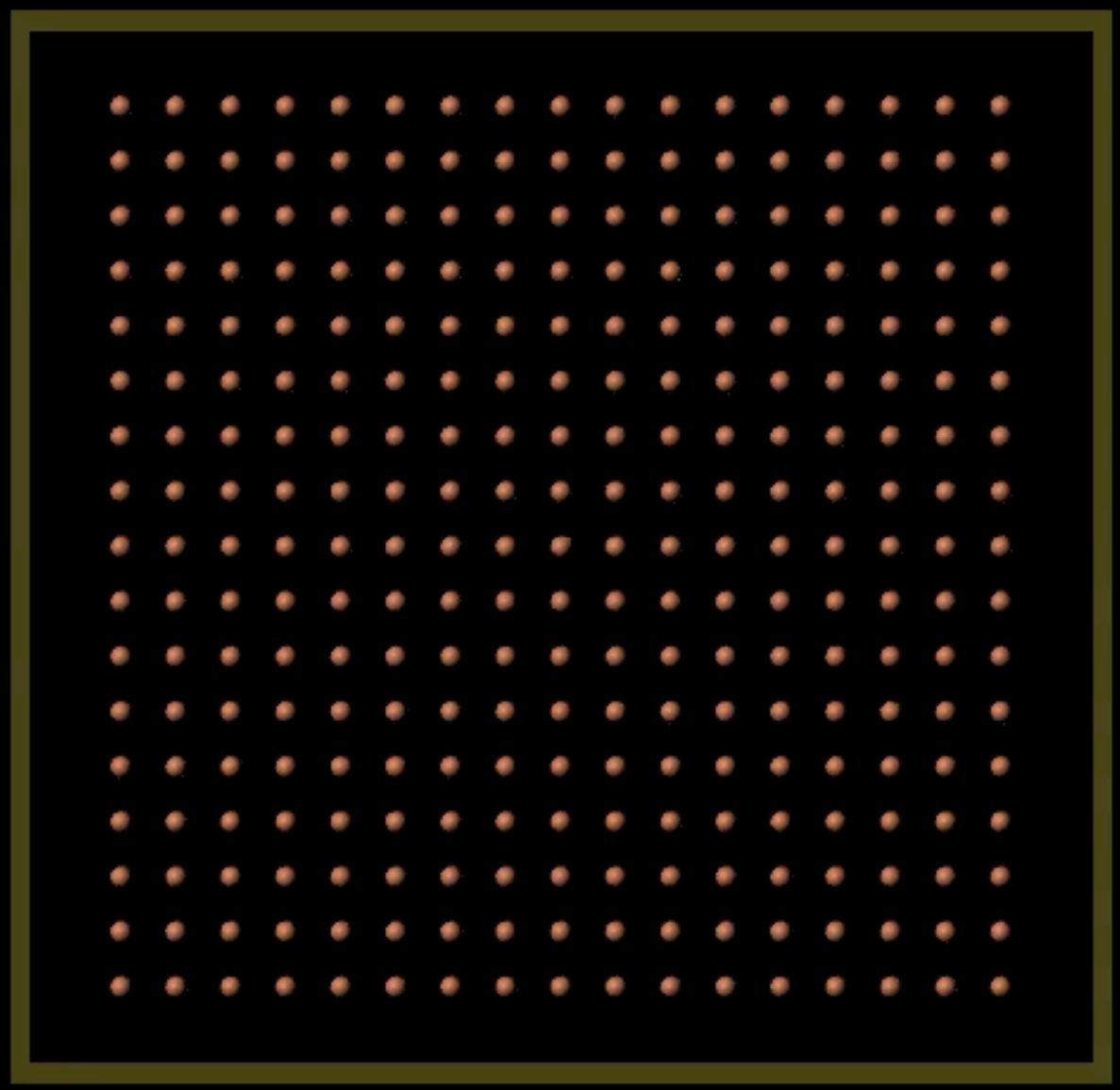
With these RULES, we can predict the "expected" area of the particles' distribution.



so expected distribution shape is a circle, with radius given by the orange line

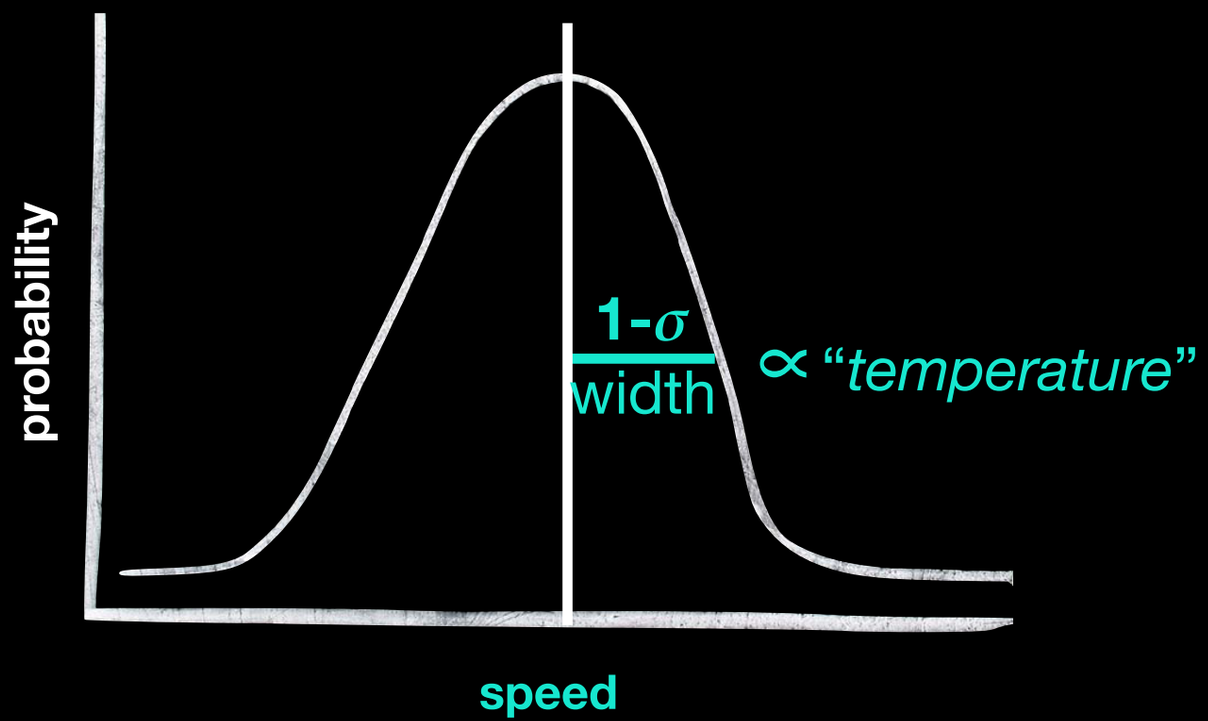
directions moved are random

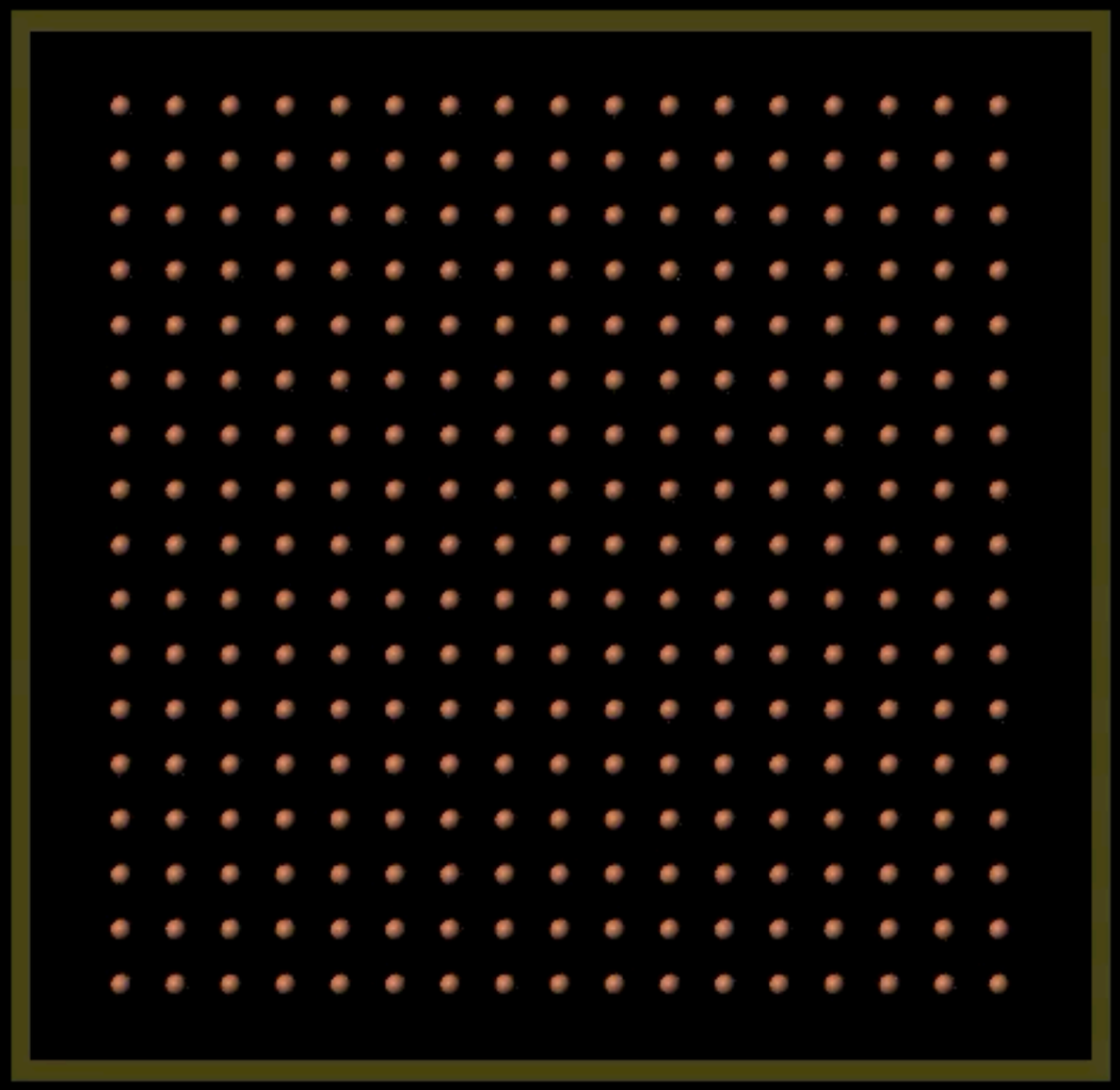
And, if we had many more particles, and allowed for the effects of collisions, here's what would happen.



The evolving yellow path shows the path of one particle, "diffusing" from the center.

If there were **many, many, many more particles**, and the system reached "thermal **equilibrium**," then the **spread in velocities** of particles in a similar 3D box would measure "**temperature**" of an ideal gas…





$$\frac{1}{2}m\overline{v^2} = \frac{3}{2}kT$$

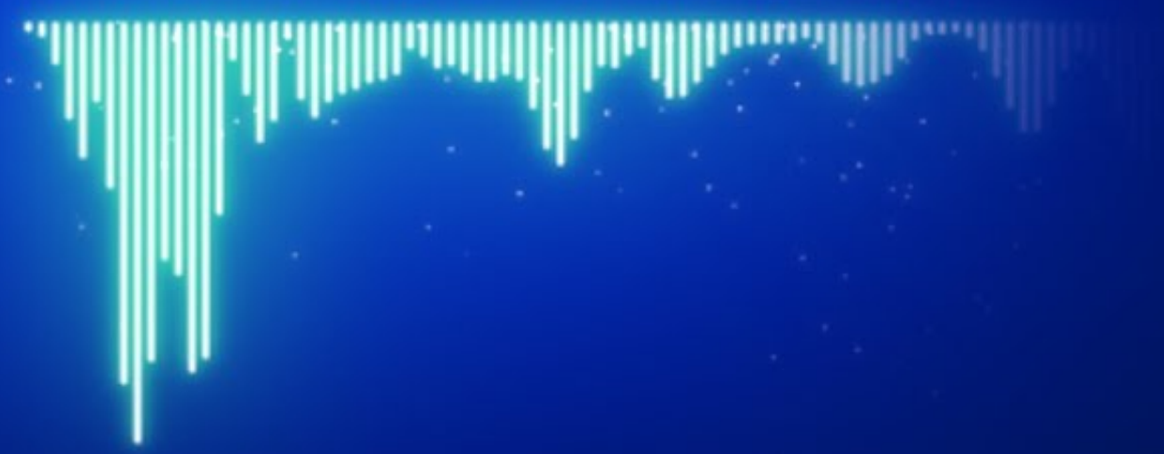
T=temperature m=particle mass k=Boltmann's constant v=velocity (speed)

(now imagine you also had gravity…
we'll leave that "3-body" problem discussion—
of very non-deterministic physics, for "Space Week"!)

Breakout groups: where do simulation or statistical models come into your life?

[contribute to the list at https://tinyurl.com/gened1112models]

I am AI



Prediction: Week 9*

to prepare for 4/1 "AI & Health" event… our agenda for today & coming weeks has been revised

Today's breakout room notes: tinyurl.com/GenEd1112-March30

Prediction: Week 10 (part 1)

Hi Everyone,

PLEASE note the three links you'll need for Thursday, below.

1--As I've mentioned in class, this week's Thursday "class" will be the Radcliffe AI & the Future of Health event for which you need to all register (if you've not already). The talks will begin at 1 PM. The zoom link for the public event should be in the email you receive from Radcliffe upon registration.

2--When the official public event ends, you, as a class, are to please switch to this private zoom link: https://harvard.zoom.us/j/95115699456?pwd=NGc3VTI3eDB1SGdnWlFPaUEzUGgwQT09
If you have any trouble with that link during the event, please send a Canvas message to your TF.

3--*During* the event (preferably before our private session starts), please post your questions to https://tinyurl.com/Radcliffe-AI-Health. I may use some of your questions in the public discussion too--so thanks in advance for that!

Please these important links & use them on Thursday.

Thanks,
Alyssa

Modern Prediction: REVISED PLAN

Week	Topic	Date			Date	Assignments
8	Intro to Modern Simulations	3-18	Where does Uncertainty come from?	Weather & Climate: Special guest: Prof. M.Linz	3-23	Gina McCarthy, Dan Kammen, Rebecca Henderson (by 3/30)
9	Modeling	3-25	Meaning of "Models" (Climate Change)	AI/Data Science/ Derek's Day	3-30	Ben Shneiderman (by 4/1), plus one of: Megan Murray, George Church, Immaculata De Vivo + Peter Kraft
10	The Future of Wealth & Health	4-1	Special AI & Health Event "at" Radcliffe	Human Behavior, Decisions, Predictions	4-6	Dan Gilbert, David Laibson (by 4/6) ["game"assignment will be due 4/13]
11	The Future of the Universe	4-8	Resolution & Uncertainty, Games	Simulating the Universe	4-13	Jill Tarter, Avi Loeb (by 4/20)
12	Artificial Intelligence & Bayesian Thinking	4-20	The Search for Life	Hypothesis-Free Prediction	4-22	Brendan Meade + Susan Murphy Ned Hall (optional) (by 4/20)
12a	The Future of the Future	4-27	Final Discussions + featured student videos		4-29	Stuart Firestein, Agustin Rayo (optional) (by 4/27)

Short Canvas assignment today will ask you to comment on each other's Forum posts.

The Prediction Project

The Past and Present of the Future

HOME ABOUT MATERIALS COURSES TALKS WRITINGS PRESS FORUM

Filter: All posts Sort by: Recent Activity Create New Post

J Julie Alarifi

Something Surprising! - The Future of Energy and Earth with Dan Kammen

Discussion

During the interview , I found it surprising when Dan Kammen mentioned that despite the fact that we have more complex, evolved, less uncertain, and...

1 0 0

G Gavin Uberti
Harvard GenEd 2021

Kammen - Changing what Actually Matters

Discussion

For me, the most surprising thing from the three videos was Daniel Kammen explaining why we should "go green" in ways that don't make sense on paper....

1 0 0

jordanlee

Kammen - Societal Impact on Environment

Discussion

Throughout the course of this interview , I feel like the relationship between the scientific studies on climate and what kinds of tangible actions individuals and...

2 0 0

Start the presentation to activate live content

If you see this message in presentation mode, install the add-in or get help at PollEv.com/app

Today's goal: discuss tags most relevant to AI & Health event on Thursday

Prediction X: Modern Simulations--THEMES/TAGS

#simulation_or_model)
#theoretical_empirical (c.f. Padua Rainbow)
#framework_model_inputs
#framework_testing
#biases
#uncertainty (c.f. puck simulation, Take a Sweater)
#approximation (c.f. Ten questions) #Heuristic
#public_reaction
#predictability
(predictability, determinism, randomness and uncertainty--use sand on shuffleboard analogy, includes #convergence, #divergence, #feedback #chaos)
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#explanation_vs_prediction (c.f. Padua Rainbow)
#technology_theoretical_computation_and_math
#technology_observational_experimental_devices_and_sensors (c.f. PtN)
#future_of_the_future
#personal_or_societal
#samplesize
#resolution
#rainbow_diagram

#rainbow_diagram

THE "PADUA" RAINBOW

Phenomenon	Observation*	Data	Rule	Theory	Explanation	Prediction

or, Experiment

Mendel

Phenomenon | Observation | Data | Rule | Prediction

Darwin

Phenomenon | Observation | Data | Theory | Explanation | Prediction

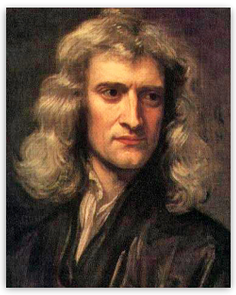
BIOLOGY

#theoretical_empirical

PHYSICS

Kepler

Phenomenon | Observation | Data | Rule | Prediction



Newton

Phenomenon | Observation | Data | Rule | Theory | Explanation | Prediction

Mendel *1865*

Phenomenon | Observation | Data | Rule | Prediction

Darwin *1859*

Phenomenon | Observation | Data | Theory | Explanation | Prediction

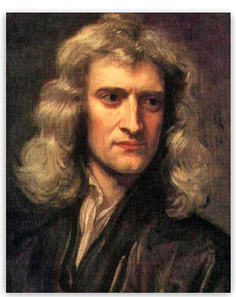
NO FULLY PREDICTIVE GENERAL THEORY

#deterministic_vs_probabilistic

FULLY PREDICTIVE GENERAL THOERY

Kepler *1609*

Phenomenon | Observation | Data | Rule | Prediction



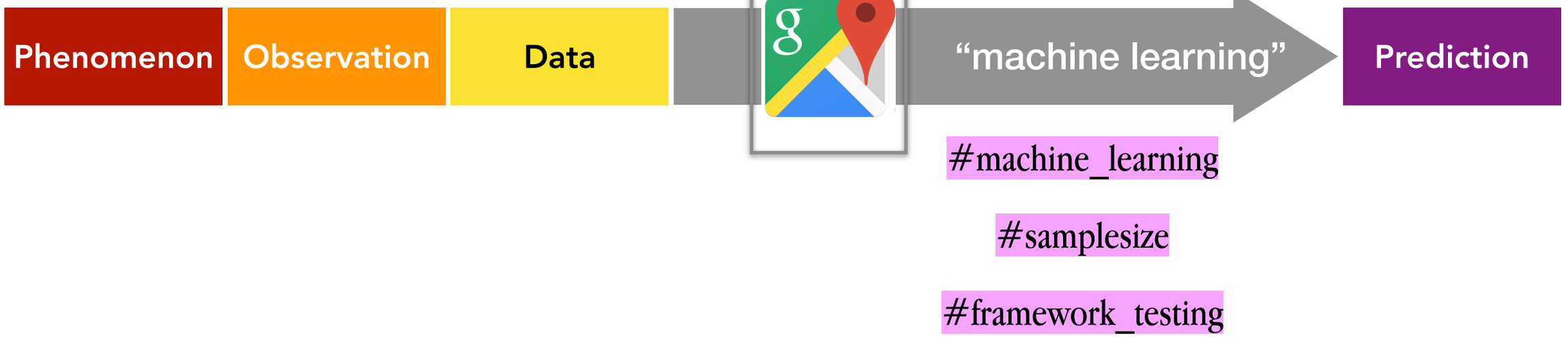
Newton *1687*

Phenomenon | Observation | Data | Rule | Theory | Explanation | Prediction

THE FUTURE OF THE FUTURE

20th century

21st century?



IMPORTANT: NOT ALL DATA SCIENCE IS AI

20th century

21st century?

#artificial_intelligence

#machine_learning

#samplesize

#framework_testing

IMPORTANT: NOT ALL DATA SCIENCE IS AI

#theoretical_empirical

Data-Driven Dilemmas posed by COVID-19

This commentary was submitted on April 21, 2020 as a proposed Op-Ed for the NYT, by Prof. Alyssa A. Goodman, Harvard University. It represents the personal views of the author, not an official position of Harvard University.

I teach "Prediction." At Harvard. But I cannot predict the outcome of the current pandemic. I am equipped, as a scientist, to understand, evaluate, and potentially act upon, the infection and death statistics we all now read every day. But as a person, I can also act out of fear. The constant dialogue in my mind between my rational self and my emotional self helps me appreciate the dilemma facing our leaders now, as they try quite literally, to save the world.

I am trained as a physicist and astronomer. I specialize in data science, and data visualization, and I teach some epidemiology in my Prediction class. While this background does not qualify me to expertly advise leaders on COVID-19 strategy, it does put me at 1 or 2 degrees of separation from many experts quoted in the press every day. And, it's very clear to me from this privileged vantage point that even true experts' predictions do not agree. Traditional mathematical models of epidemics use the now-infamous "R_0" reproduction number, lethality rates, understanding of infection mechanisms, analysis of co-morbidities, and other medical measures to estimate outcomes. Bold data-science approaches eschew understanding of infectious disease, and base predictions purely on "training data" that amounts to information about what has actually happened in countries farther along in their epidemic curves than others.

Both groups—epidemiologists using infectious disease expertise to model a pandemic's course and data scientists making predictions using algorithms trained only on real-world actions and outcomes, suffer at this point from a severe lack of reliable data to input to their forecasts. In the understand-to-predict disease spread approach, uncertainty is reduced as more is known about mechanisms of infection and recovery, about true numbers of people susceptible and immune to the disease, and about the properties of the virus and of the people upon whom it has a range of effects. In the least medically-oriented of the data-science approaches, what's needed is a wide variety of circumstances (e.g. ranges of policies on social distancing, travel restrictions, population density, population demographics), measured over long-enough time spans, to let algorithms base forecasts on what happened elsewhere in the past. We simply do not have enough data at this point for either of these approaches to work with high precision, but either is good enough to forecast extremes.

predictionx.org/data-driven-dilemmas

Mechanism v. "Data Science"

#theoretical_empirical

Both groups—epidemiologists using infectious disease expertise to model a pandemic's course and data scientists making predictions using algorithms trained only on real-world actions and outcomes, suffer at this point from a severe lack of reliable data to input to their forecasts. In the understand-to-predict disease spread approach, uncertainty is reduced as more is known about mechanisms of infection and recovery, about true numbers of people susceptible and immune to the disease, and about the properties of the virus and of the people upon whom it has a range of effects. In the least medically-oriented of the data-science approaches, what's needed is a wide variety of circumstances (e.g. ranges of policies on social distancing, travel restrictions, population density, population demographics), measured over long-enough time spans, to let algorithms base forecasts on what happened elsewhere in the past. We simply do not have enough data at this point for either of these approaches to work with high precision, but either is good enough to forecast extremes.

#samplesize #technology_theoretical_computation_and_math #public_reaction #unknown_unknowns

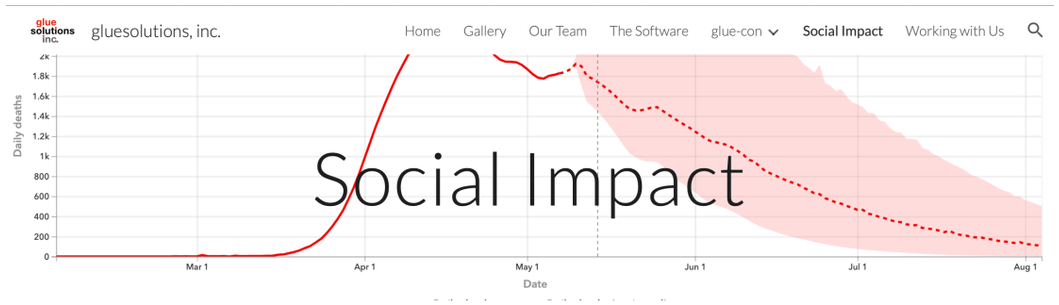
#uncertainty #biases #framework_testing #personal_or_societal

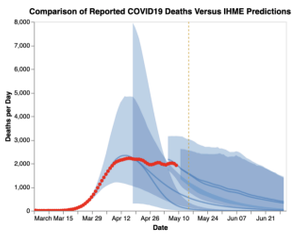
Breakout Rooms Round 1: Visit links on next slide, try the tool, discuss connections to above tags, make notes for your group in the google doc at https://tinyurl.com/GenEd1112-March30

Mechanism (v.) Data Science & Uncertainty

#samplesize #technology_theoretical_computation_and_math #public_reaction #unknown_unknowns

#uncertainty #biases #framework_testing #personal_or_societal





IHME Models over time, for the United States, for 4 representative dates, made with the interactive tools offered below.

IHME Model Uncertainty, Visualized over Time

The **Institute for Health Metrics and Evaluation (IHME)** creates, maintains, updates, and publishes an open-source statistical model of the impact of the COVID-19 pandemic, based on open-data resources. As a public service, **glue solutions, inc.** here offers an online tool for visualizing the evolution of the IHME models over time.

The general public has seen many versions of the IHME "Daily Deaths" plots, including in several White House briefings. Our goal here is to offer a look at **how the models change**—appropriately, in response to new data and information—over time, and how that affects model updates. In a companion essay online at the Prediction Project site, we offer more context on why this evolution is so interesting.

(Banner above shows sample IHME "Daily Deaths" graphic, from 14 May 2020.)

What's this tool for? Using the interactive graphics below, you can re-create the display of deaths/day akin to what would have been visible at IHME's (site on a range of modeling dates, for any region you select. In addition, you can show more than one model (date) at a time, to make comparisons.

How should I interpret what I see? In each of the panels below: **red** dots show reported *actual* deaths per day; solid **blue** lines show forecasts, and light regions show uncertainty bands. Those **uncertainty bands** indicate ranges of possible outcomes, as forecast on the date when the model was made. Th should account for 95% of possible outcomes. As one can see by moving the time slider below each graph, the model and its associated uncertainty bar time. As more and more models are added, regions where shading appears darkest are regions where models have been most consistent.

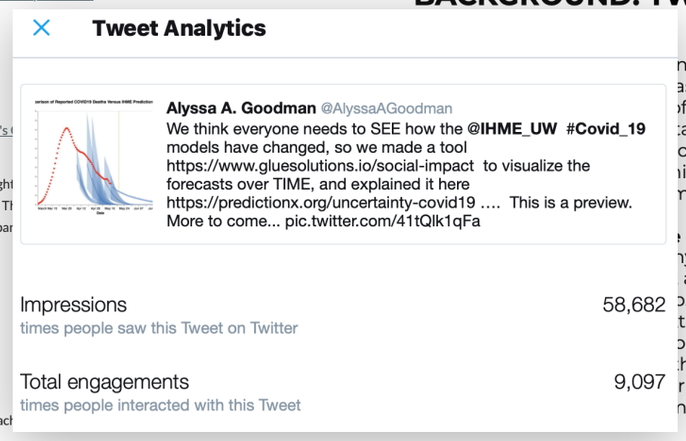
There are **four versions** of the IHME evolution visualization offered below. They are as follows (with source links in [brackets]):

1. For the United States, showing only 4 representative model dates. [source, GitHub] [mobile site]
2. For the United States, offering a wide range of model dates [source, GitHub]
3. For the World, showing only 4 representative model dates [source, GitHub] [mobile site]
4. For the World, offering a wide range of model dates [source, GitHub]

This content is **licensed** as CC BY, with attribution "glue solutions, inc." Static graphics can be extracted using the three dots at the upper right of each

How can I share interesting graphs I create? Join the discussion at the 10QViz.org IHME COVID-19 Model Uncertainty Visualization page to upload your graphic and tell the world what it shows you. (You can download your graphic using the three dots at the top right of each panel below.)

At present, this site's visualization interactions work best on larger screens. We provide links to standalone views of the visualization showing 4 representative model dates that may work better on many mobile devices.



gluesolutions.io/social-impact

The Prediction Project
The Past and Present of the Future

HOME ABOUT MATERIALS COURSES TALKS WRITINGS PRESS FORUM

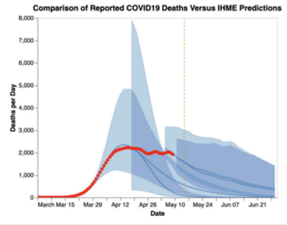
Uncertainty about Uncertainty

by Alyssa A. Goodman, May 18, 2020

This essay accompanies the release of an online tool for visualization of IHME COVID-19 forecasts' evolution over time and a community discussion of visualizations created with the tool.

Uncertainty about the future has motivated predictions for millennia. Sometimes, we're just curious—but other times, we really need to know. As the present pandemic evolves, our urgent societal need to plan has motivated many scientists to predict the spread and effects of the novel coronavirus.

BACKGROUND: TWO BROAD CLASSES



Click here open the interactive site and explore the visualizations on your own.

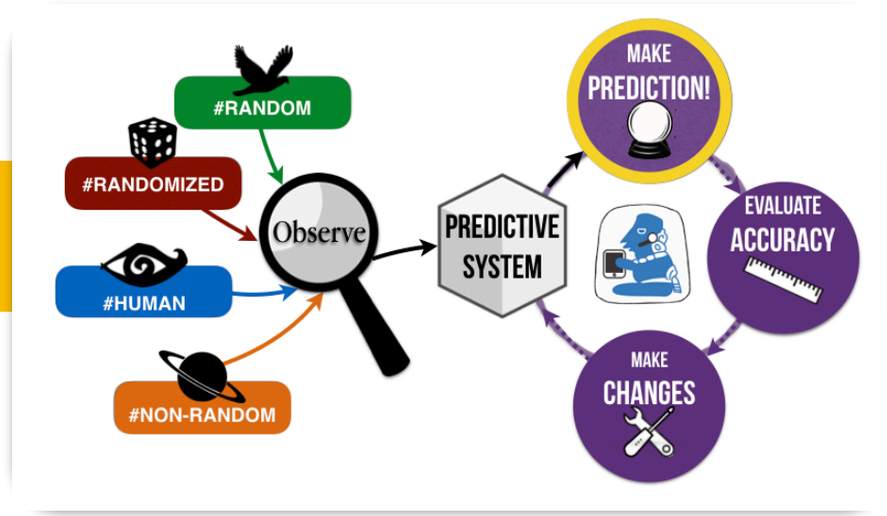
…ns being used by governments to …asses: infectious disease models …f how contagion spreads; and …tatistical models informed …outcomes. To the uninitiated, …ich rely on statistical …ne—but they are not.

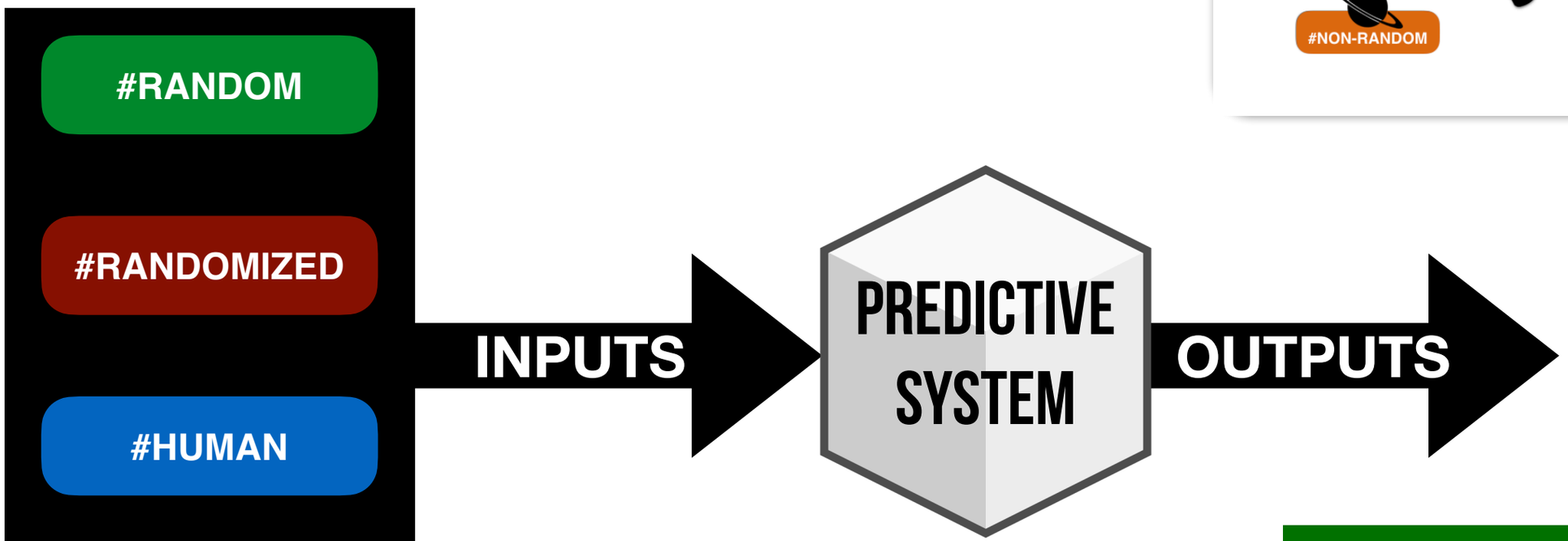
…e take into account, with varying …y, and importantly why, people are susceptible, infected, immune, or … any given point in time and space. The mathematics of these models …s called "Susceptible," "Exposed," "Infected," and "Removed," and so are …t the philosophical other end of the modeling spectrum, what we call …oaches use information about cases, testing, hospital admissions, and …hat forecast what will happen under various combinations of conditions, …r similar conditions in the past. Purely mechanism-agnostic …nedically-informed information about how an infectious disease spreads.

predictionx.org/uncertainty-covid19

#framework_model_inputs

Inputs, from the Framework





“HUMAN”

STATISTICAL

SIMULATION

COMBINATIONS

Weather/Climate *simulating* spatial processes	Systems Biology *simulating* non-spatial processes
Genomics *statistical* predictions of physical traits	Mobile Health *statistical* predictions of behavior

#theoretical_empirical

Which (also) use "AI," and how?

SIMULATION	SIMULATION	STATISTICAL	STATISTICAL
Weather/Climate *simulating* spatial processes	Systems Biology *simulating* non-spatial processes	Genomics *statistical* predictions of physical traits	Mobile Health *statistical* predictions of behavior

#theoretical_empirical

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Courses
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2019-2020 Spring

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Announcements
Syllabus
Modules
Assignments
Discussions
Grades
Files
Pages
People
Support Resources
Manage Course
Course Emailer
Syllabus Export
Library Reserves
Academic Integrity Policy
Lecture Recordings
ZoomXL
Course Evaluations
Class Notebook
Quizzes
Collaborations
Outcomes
Rubrics
Settings

Modern Predictions & AI

Weather & Climate (NASA Goddard)

Weather & Climate Game/Curriculum Google Doc

Canvas Page on Modern Predictions & AI lists several helpful videos & websites

El Niño and Why It's So Hard To Predict the Weathe

Weather Sandbox (Simulation Game output)

Simulation code: https://mega.nz/#!xZ9TxJpT!RGF4ToGHrD..

https://www.youtube.com/watch?v=AYW_awzW4Es

Artificial Intelligence

#artificial_intelligence

#machine_learning

Short example "learning to speak AI" video

https://www.youtube.com/watch?v=DHN7mVYzxSA&feature=youtu.be

based on AI/ML glossary here

Best resource: Crash Course series on PBS

Intro Episode on Artificial Intelligence

Neural networks from crash course stats

https://youtu.be/JBlm4wnjNMY

Machine learning and artificial intelligence CrashCourse computer science

https://youtu.be/z-EtmaFJieY

Google maps info

Google Ground Truth

https://youtu.be/FsbLEtS0uls

About AI & ML in Google maps

ML translatIon

The A-Z of AI and Machine Learning: Comprehensive Glossary

Ultimate Terminology You Need to Know

Oleksii Kharkovyna Follow
Jul 8, 2019 · 14 min read ★

I don't know whether you know it or not… but there are a lot of misconceptions surrounding artificial intelligence. While some assume it means robots coming to life to interact with humans, other ones believe it is a superintelligence that soon will take over the world. Well, I consider this to be very discouraging. Not for me to explain the importance of knowing what AI is and what it can really do (especially if you are thinking about establishing your own AI expertise, or you are already using it).

Today, I offer to take care of terminology and don't be so naive anymore. In this article, I'll aim to highlight some of the most necessary concepts in a clear, straightforward way.

So, feel free to grab your coffee and a comfortable chair, and just dive in. Or use it as a reference anytime you want to brush up your knowledge.

Artificial Intelligence and Machine Learning Terms A to Z:

knowledge.

L

- **Limited memory**

systems with short-term memory limited to a given timeframe

Hmm… how about just "classification"?

All those algorithms build a mathematical model, known as "training data", in order to make predictions or decisions.

While AI is a technique that enables machines to mimic human behavior, Machine Learning is a technique used to implement Artificial Intelligence. It is a certain process during which machines (computers) are learning by feeding them data and letting them learn a few tricks on their own, without being explicitly programmed to do so. So all-in-all, Machine Learning is the meat and potatoes of AI.

- **Machine Perception**

Machine perception is the capability of a computer system to interpret data in a manner that is similar to the way humans use their senses to relate to the world around them. The basic method that the computers take in and respond to their environment is through the attached hardware.

- **Machine translation**

Machine translation (MT) is an automated translation. It is the process by which computer software is used to translate a text from one natural language (such as English) to another (such as Spanish).

N

- **Narrow Intelligence**

Narrow AI is AI that is programmed to perform a single task — whether it's checking the weather, being able to play chess, or analyzing raw data to write journalistic reports.

- **Natural language processing (NLP)**

Natural Language Process, or NLP for short, is a field of study focused on the interactions between human language and computers. NLP helps machines "read" text by simulating the human ability to understand language. It sits at the intersection of computer science, artificial intelligence, and computational linguistics.

- **Neural networks**

Learning to speak "artificial intelligence"…

Classification

In machine learning and statistics, classification is a supervised learning algorithm technique that allows machines to assign categories to data points (categorize data into a given number of classes). Classification (decision trees and neural network classifiers) can be used for text classification in marketing.

machine learning *statistics* *classification* *supervised learning*

algorithm *machines* *data* *classes* *decision trees* *neural network*

data (input) information

statistics an approach to analyzing data, using an *algorithm* defined by rules, which can be implemented on *machines*

one algorithmic approach to (statistical) tasks is artificial intelligence (AI)

classification algorithms' task is to categorize data

using examples of categories desired, one can "train" or "supervise" an algorithm to learn to classify data. Such an algorithm is just one kind of AI, called *supervised learning* which itself is one type of the more general class of algorithms known as *machine learning (ML)*

types of supervised ML classifiers are *decision trees* and *neural network*

which ultimately sort data into *classes*

A random forest is simply a collection of *decision trees* whose results are aggregated into one final result. Their ability to limit overfitting without substantially increasing error due to bias is why they are such powerful models.

towardsdatascience.com/decision-trees-and-random-forests-df0c3123f991

Explore | Guided Tours | Search | View | Settings

Install Windows Client

Use Layer Manager to Control User Settings

Name My Location
Lat 37:47:15 Alt 0 m
Lng -123:35:23
View From This Location

2015/02/11 04:40:33
Real Time
Now

Galactic Plane Mode

WorldWide Telescope

ZOONIVERSE
REAL SCIENCE ONLINE

Look At: Sky
Imagery: Digitized Sky Survey (Color)
Image Crossfade

Tracking: GLIMPSE/MIPSGAL
1 of 3

N
Scorpius
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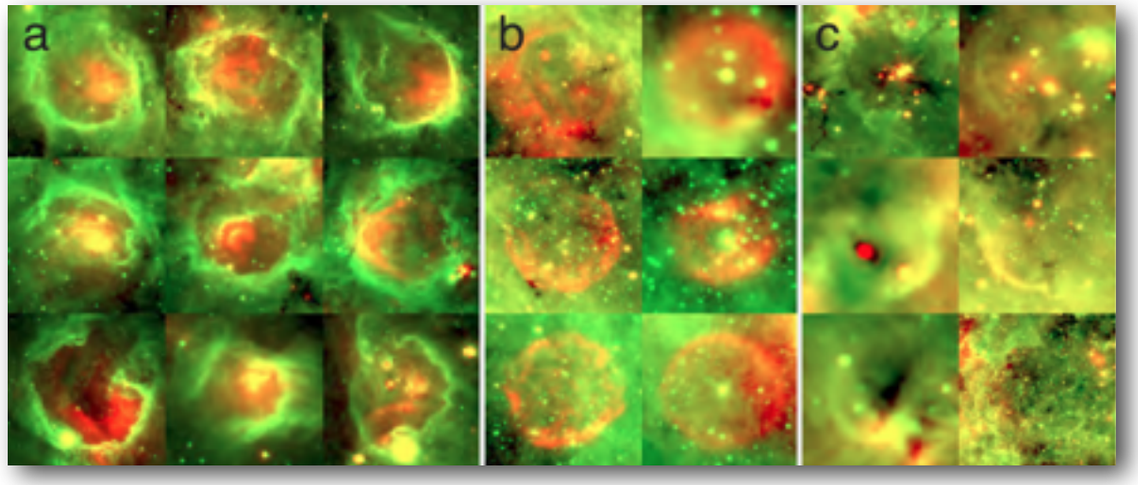
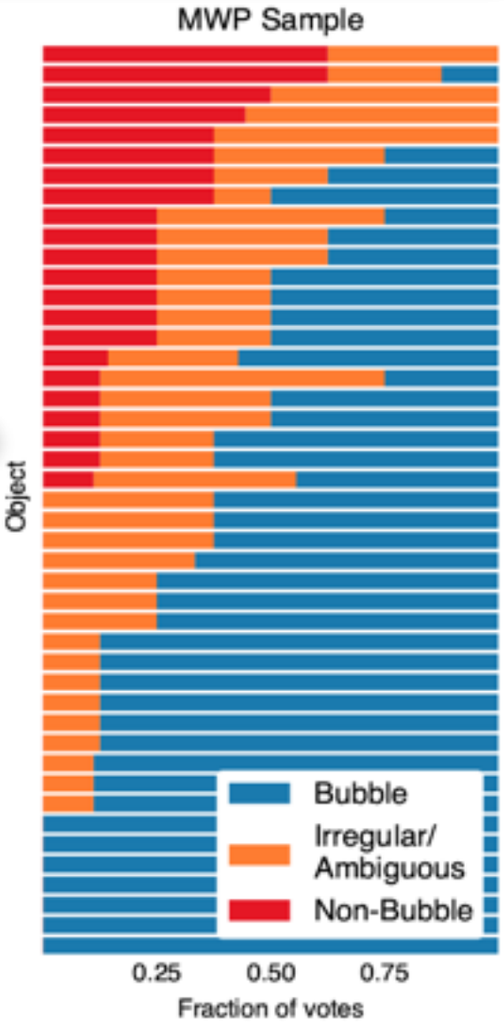
Pismis 24 and | NGC6334 | NGC6357 | NGC6374 | NGC6383 | NGC6396 | NGC6404 | Lesath | Shaula | HR6397 | HR6405

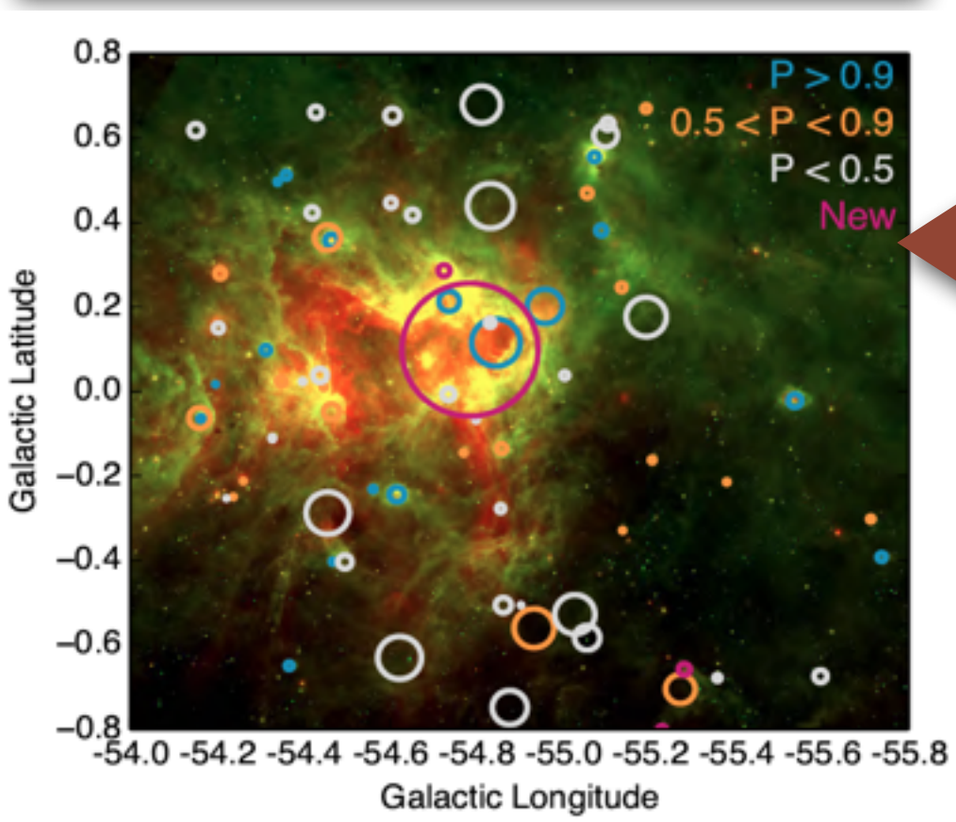
BIG DATA AND "HUMAN-AIDED COMPUTING"



random forest

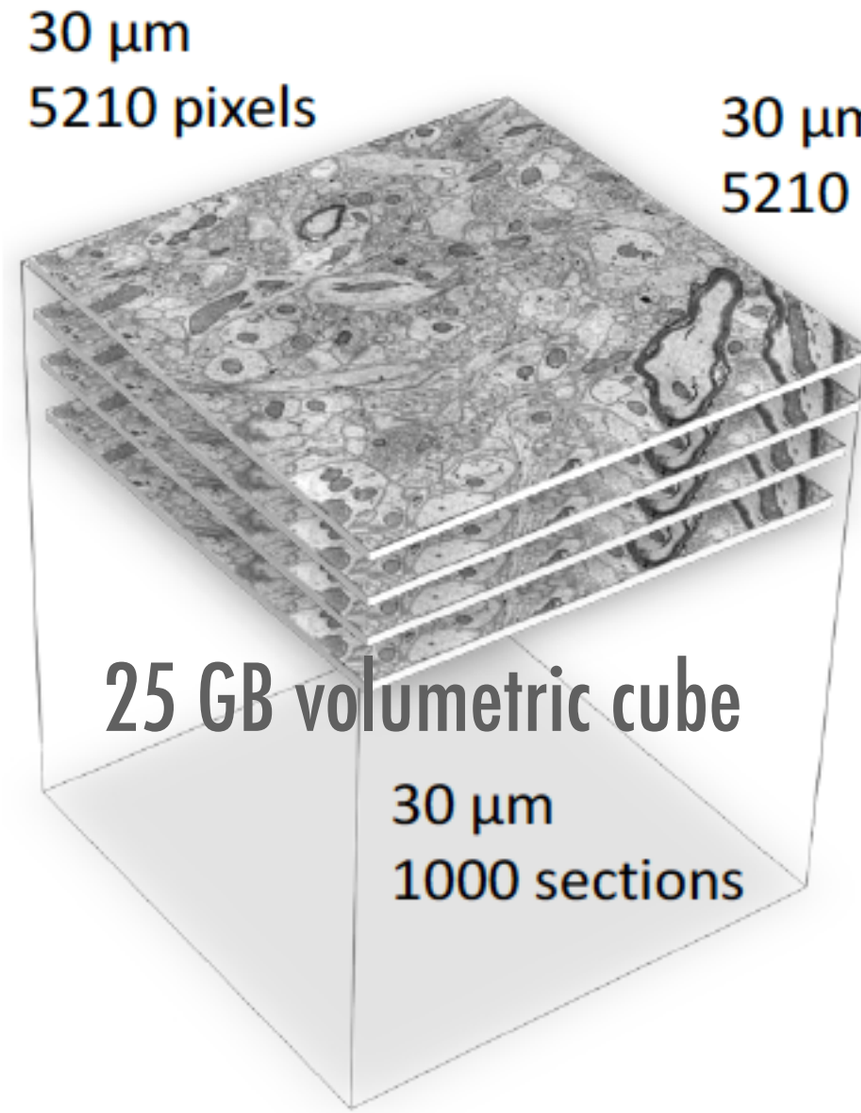
machine-learning algorithm (Brut)



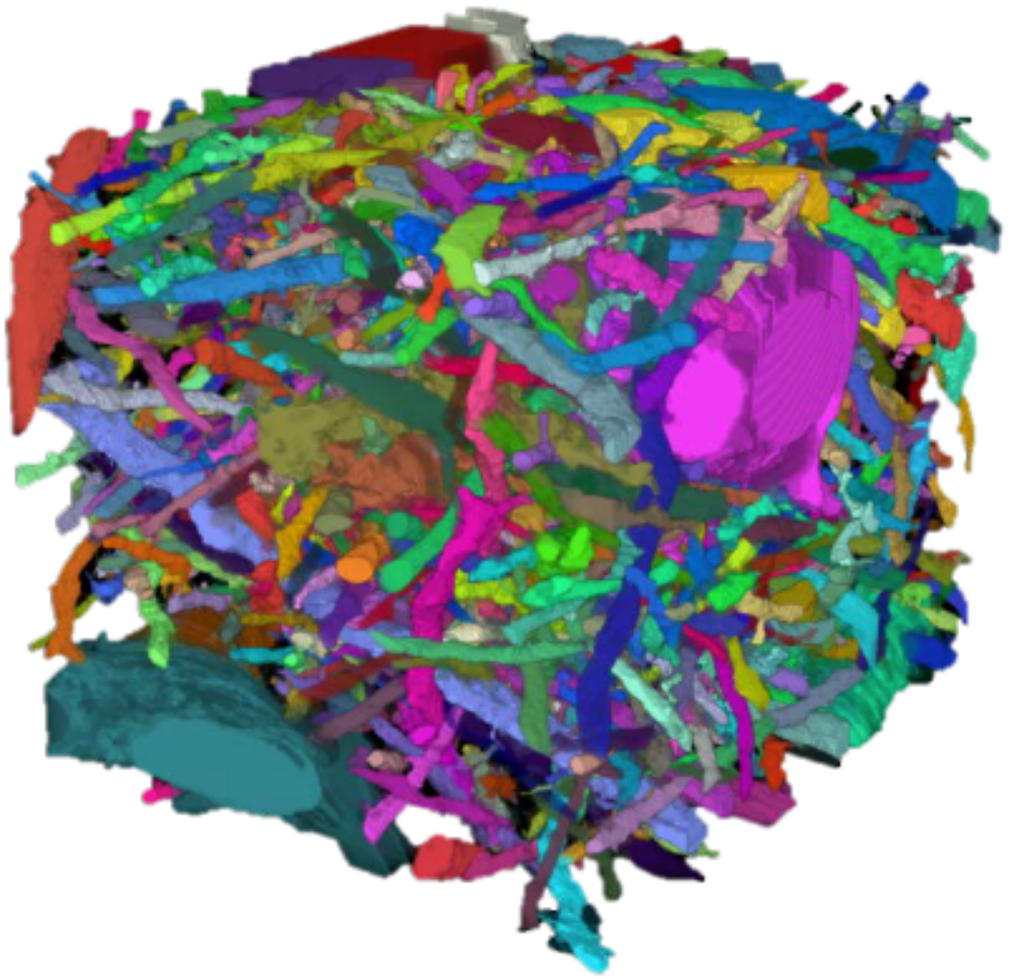


example here from: ***Beaumont****, Goodman, Kendrew, Williams & Simpson 2014; based on* ***Milky Way Project*** *catalog (Simpson et al. 2013), which came from* ***Spitzer/GLIMPSE*** *(Churchwell et al. 2009, Benjamin et al. 2003), cf. Shenoy & Tan 2008 for discussion of HAC;* ***astroml.org*** *for machine learning advice/tools*

BIG DATA AND "HUMAN-AIDED COMPUTING"



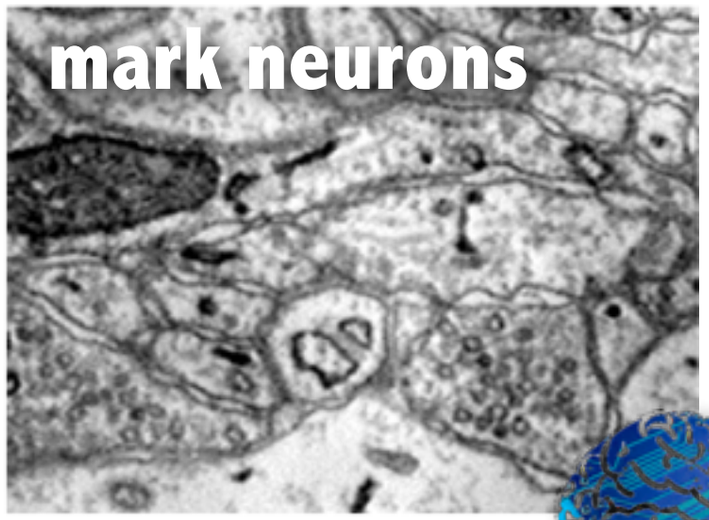
EM images

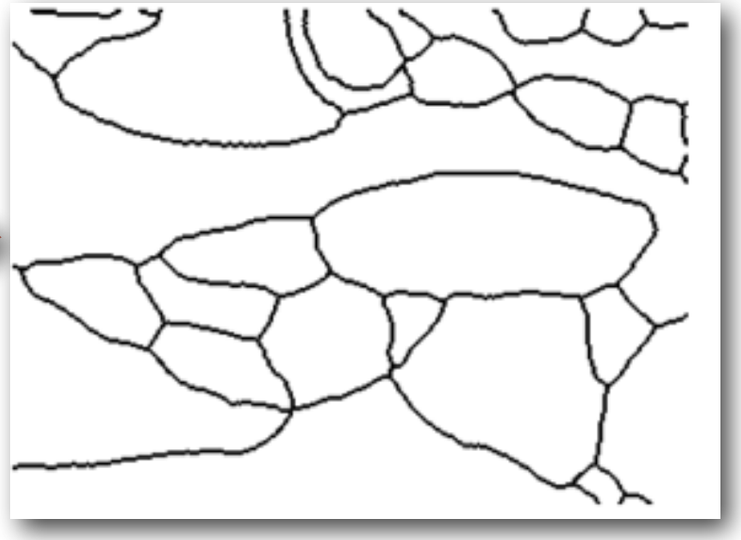


Reconstruction

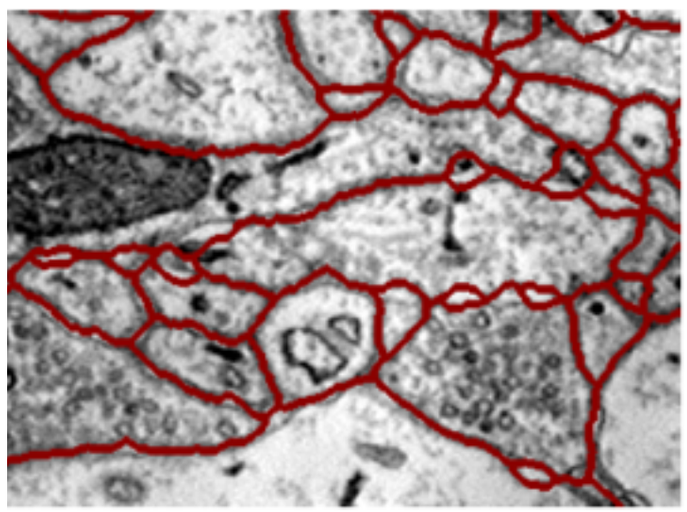
example here from: Kaynig...Lichtman...Pfister et al. 2013, "Large-Scale Automatic Reconstruction of Neuronal Processes from Electron Microscopy Images"; cf. Shenoy & Tan 2008 for discussion of HAC; ***astroml.org*** *for machine learning advice/tools*

BIG DATA AND "HUMAN-AIDED COMPUTING"





random forest machine-learning algorithm (RF+CRF)



example here from: Kaynig...Lichtman...Pfister et al. 2013, "Large-Scale Automatic Reconstruction of Neuronal Processes from Electron Microscopy Images"; cf. Shenoy & Tan 2008 for discussion of HAC; ***astroml.org*** *for machine learning advice/tools (Note: RF=Random Forest; CRF=Conditional Random Fields.)*

#artificial_intelligence(c.f. Derek's Day)

Breakouts, Round 2: Derek's Day

What processes, phenomena would you add to "Derek's Day," and are they "AI" or just "Data Science"?
(And, yes, all AI is also Data Science.)

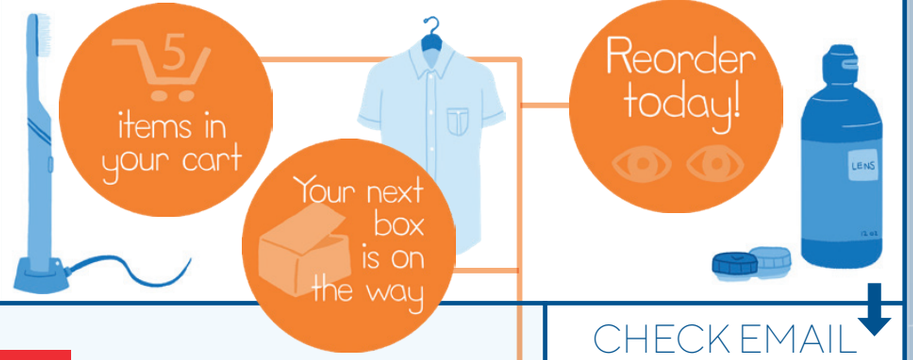
Morning

START

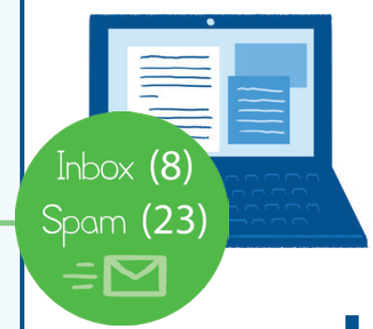
FINISH

WAKE UP

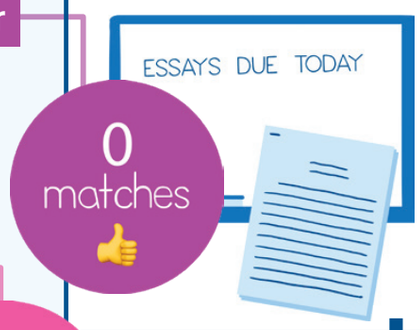
PERFORM MORNING ROUTINE



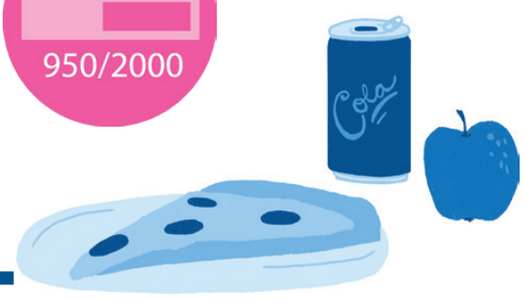
CHECK EMAIL



GO TO CLASS



EAT LUNCH



ATTEND SEMINAR

GET COFFEE

PERFORM CIVIC DUTY

FLY HOME

The board game

DEREK'S DAY

Algorithmic Forecasting in Everyday Life

AI and Algorithms

Mental health

Sales forecasting

Spam filtering

Plagiarism checker

Longevity assessment

Bayesian theory in juries

Landing optimization

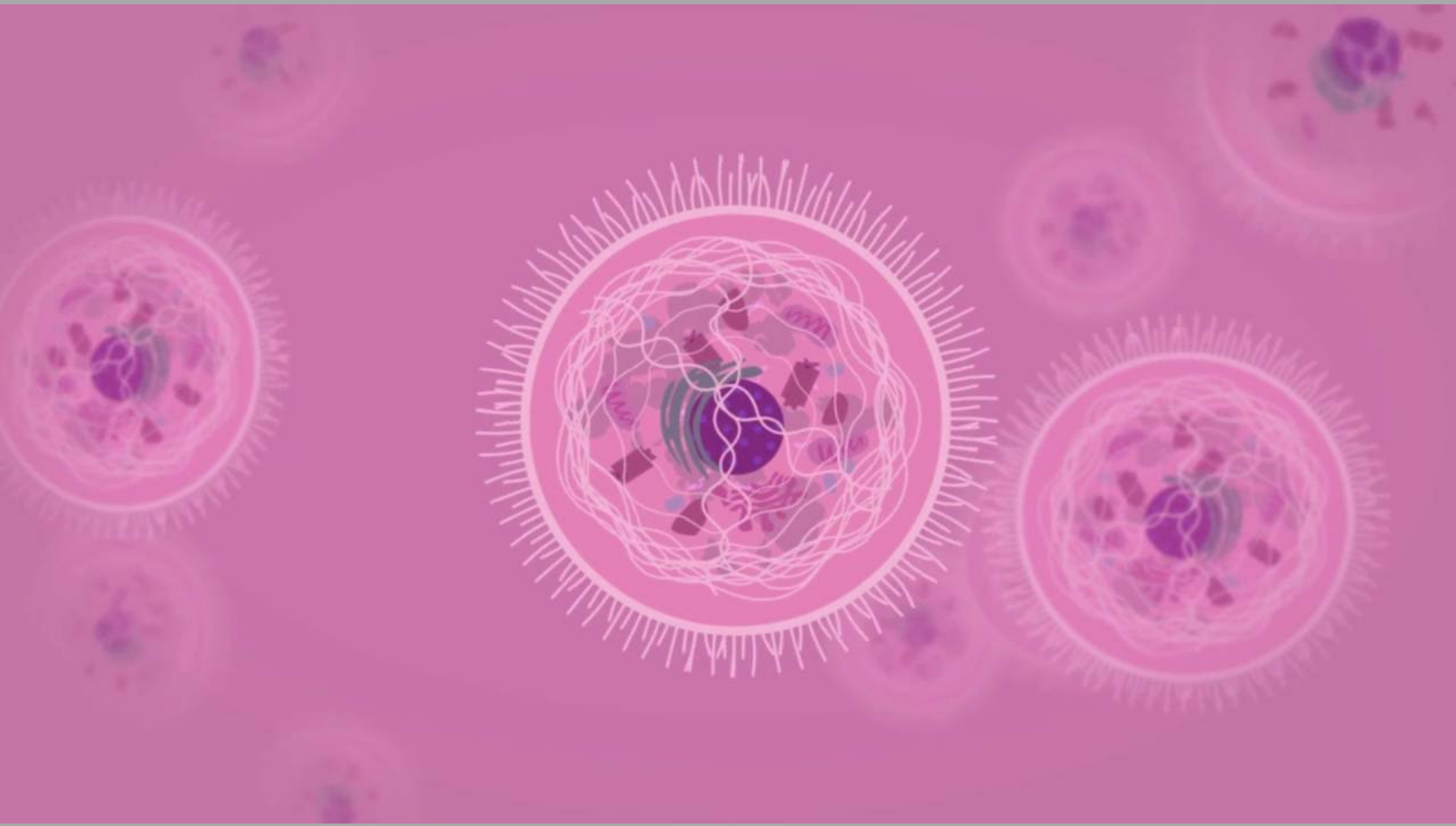
The Adpocalypse

Evening

Afternoon

extra slides

Systems Biology *simulating* non-spatial processes



https://www.youtube.com/watch?v=dchHebGDfkc