

Artificial Intelligence Inputs; A Non-Technical Foundation

Quantifying a Systems Approach to Artificial
Intelligence Integration;
&
Examining Some Interesting Algorithms.



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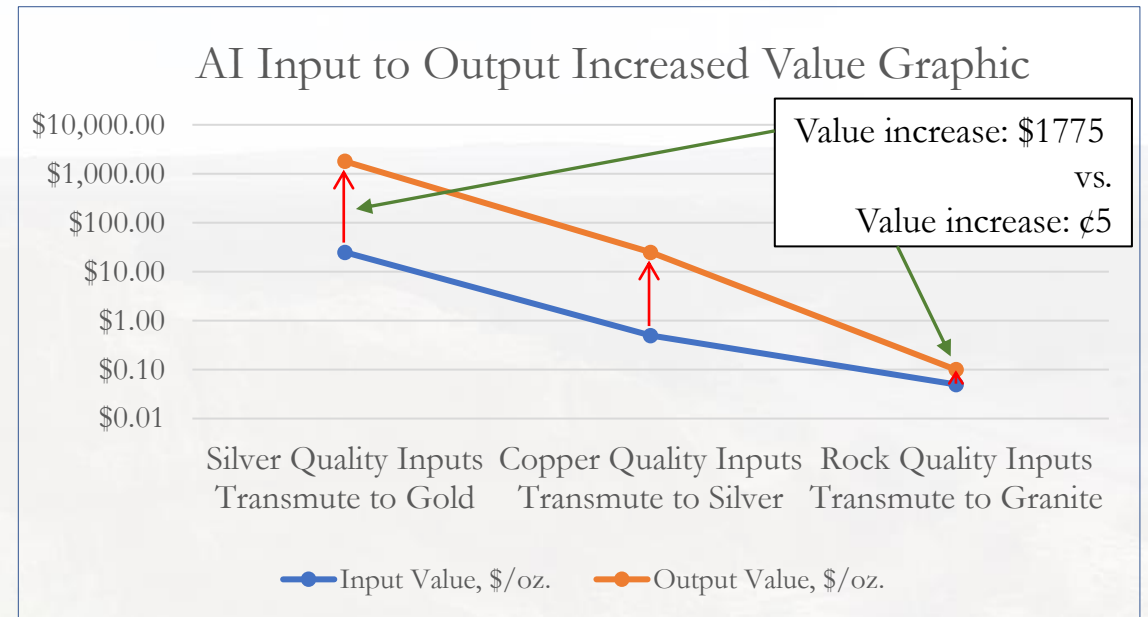


Silver in, Gold Out

“It is always better to improve the inputs.”



AI can only enhance the underlying Inputs.



Space-Time Variables (STV) Analysis

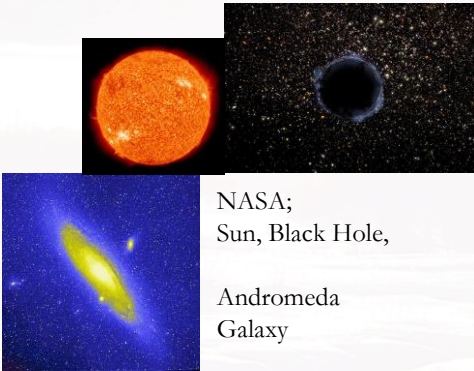
Procedure for Analysis (in a 4-D Universe)

Simultaneously:

1. From the Universe, identify A/B-Side (Input/Prediction) Variables; &
2. Identify the Space-Time domain of the implementation.

Ex.

Temperature in 4,000,000,000 years



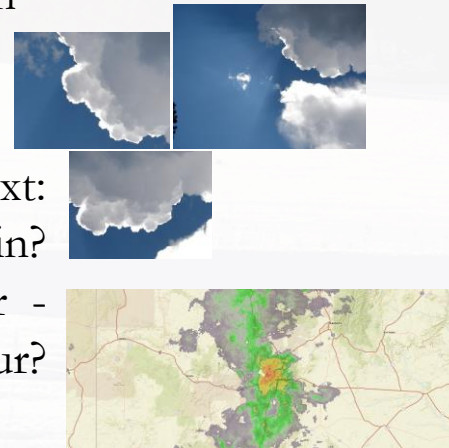
Ex. “caption generator” or “news-article generator”

Collections of Words

Collections of Frequencies from s. to hrs.

Ex. Is it sunny in the next: 5 Min?

Ground Observation vs Radar - 1 Hour?



Ex. Driverless crash-avoidance, Tesla Model 3 autopilot Crash, Taiwan, June 2020, the driver sees it now



Standard Model of Elementary Particles

three generations of matter (fermions)			interactions / force carriers (bosons)	
I	II	III		
mass: $\approx 2.2 \text{ MeV}/c^2$ charge: $2/3$ spin: $1/2$ u up	mass: $\approx 1.28 \text{ GeV}/c^2$ charge: $2/3$ spin: $1/2$ c charm	mass: $\approx 173.1 \text{ GeV}/c^2$ charge: $2/3$ spin: $1/2$ t top	mass: 0 charge: 0 spin: 1 g gluon	mass: $\approx 124.97 \text{ GeV}/c^2$ charge: 0 spin: 0 H higgs
mass: $\approx 4.7 \text{ MeV}/c^2$ charge: $-1/3$ spin: $1/2$ d down	mass: $\approx 96 \text{ MeV}/c^2$ charge: $-1/3$ spin: $1/2$ s strange	mass: $\approx 4.18 \text{ GeV}/c^2$ charge: $-1/3$ spin: $1/2$ b bottom	mass: 0 charge: 0 spin: 1 γ photon	
mass: $\approx 0.511 \text{ MeV}/c^2$ charge: -1 spin: $1/2$ e electron	mass: $\approx 105.66 \text{ MeV}/c^2$ charge: -1 spin: $1/2$ μ muon	mass: $\approx 1.7768 \text{ GeV}/c^2$ charge: -1 spin: $1/2$ τ tau	mass: 0 charge: 0 spin: 1 Z Z boson	
mass: $< 1.0 \text{ eV}/c^2$ charge: 0 spin: $1/2$ ν_e electron neutrino	mass: $\approx 0.17 \text{ MeV}/c^2$ charge: 0 spin: $1/2$ ν_μ muon neutrino	mass: $\approx 18.2 \text{ MeV}/c^2$ charge: 0 spin: $1/2$ ν_τ tau neutrino	mass: 0 charge: ±1 spin: 1 W W boson	

Labels: QUARKS (u, c, t, d, s, b), LEPTONS (e, μ, τ, ν_e, ν_μ, ν_τ), GAUGE BOSONS (g, γ, Z, W), SCALAR BOSONS (H).

Ex. Temperature in 1 microsecond

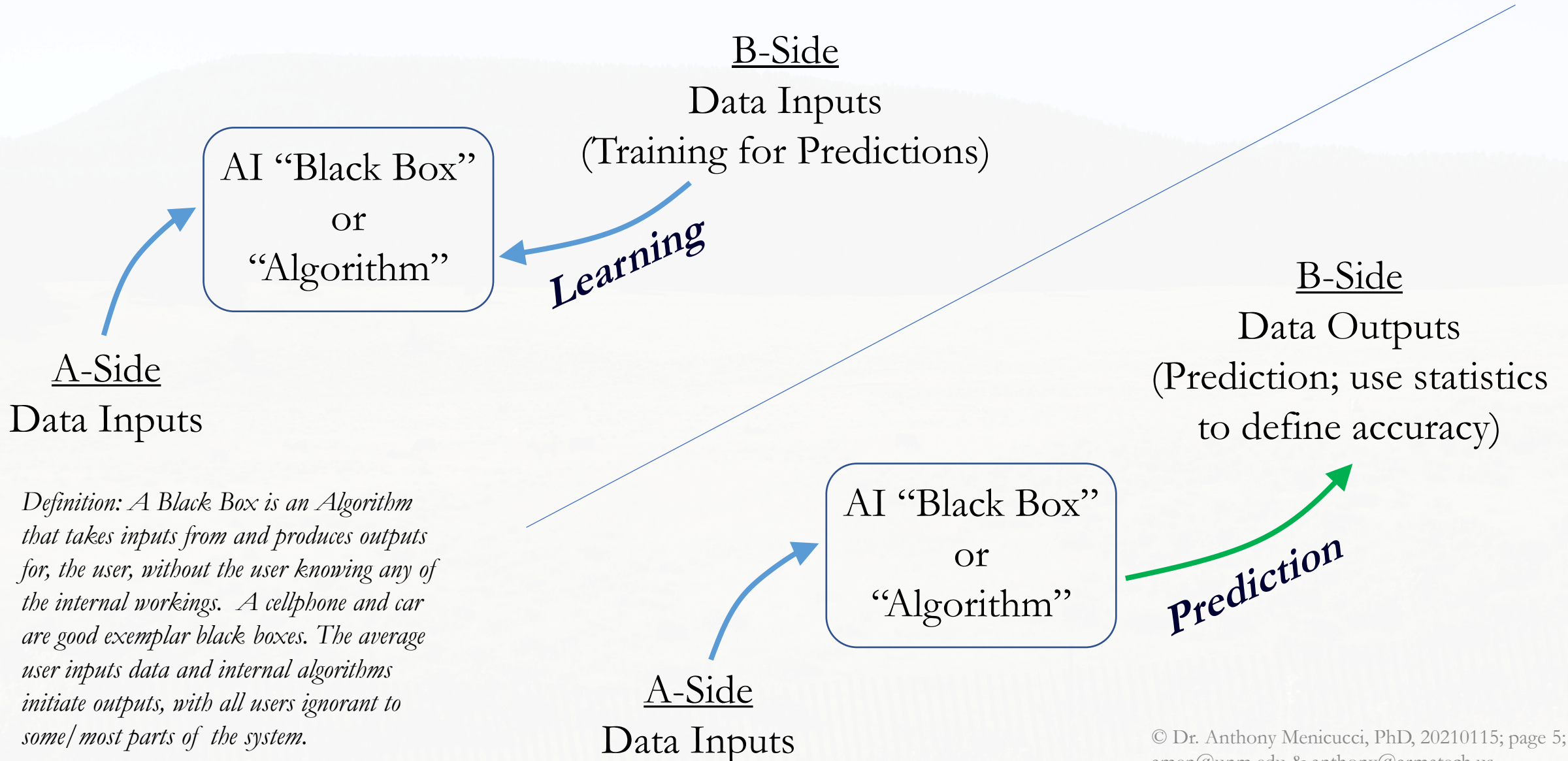
Ex. Ideal Gas Relationship:
 $PV = NRT$;
Other Derived Units:
ex. Pressure, Temperature,
Energy, Momentum ...

Slower, ~ years⁹

Smaller, ~ m.⁻¹²

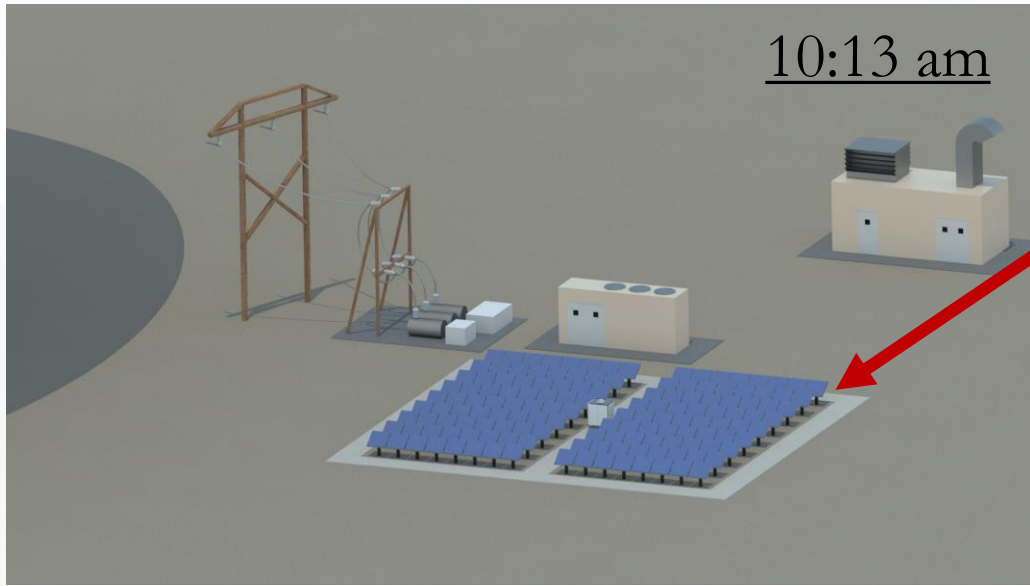
Bigger, ~ light-years¹⁰

Let us use AI to Learn and then Predict



Definition: A Black Box is an Algorithm that takes inputs from and produces outputs for, the user, without the user knowing any of the internal workings. A cellphone and car are good exemplar black boxes. The average user inputs data and internal algorithms initiate outputs, with all users ignorant to some/most parts of the system.

STV #1; Is it Sunny Over Solar Panels in 5 min.?



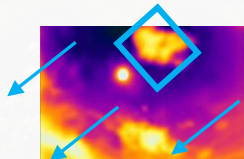
When will these solar panels stop producing electricity because of the clouds?



A-Side

- Pictures of the clouds and sun from the ground

Black Box, Algorithm

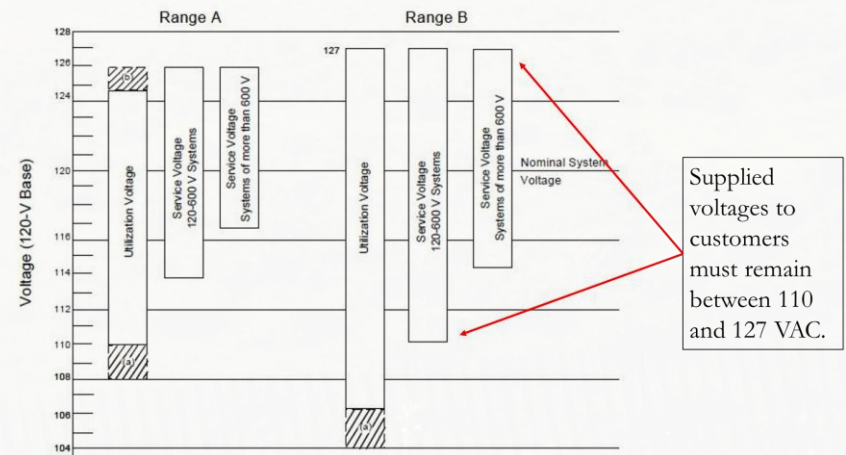


B-Side

- Solar Panel Power Output, in 5 min.



NEMA-ANSI C84.1 Voltage Ranges



STV #2; Is it Sunny Over Solar Panels in 30 min.?

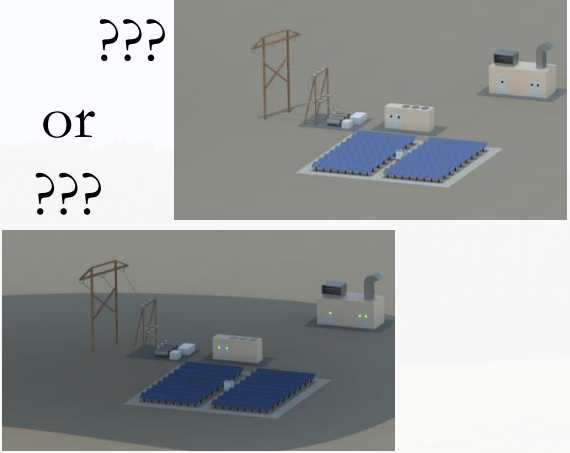
10:13 am



10:18 am



10:33 am



A-Side

- Radar or Satellite Images



Black Box, Algorithm

B-Side

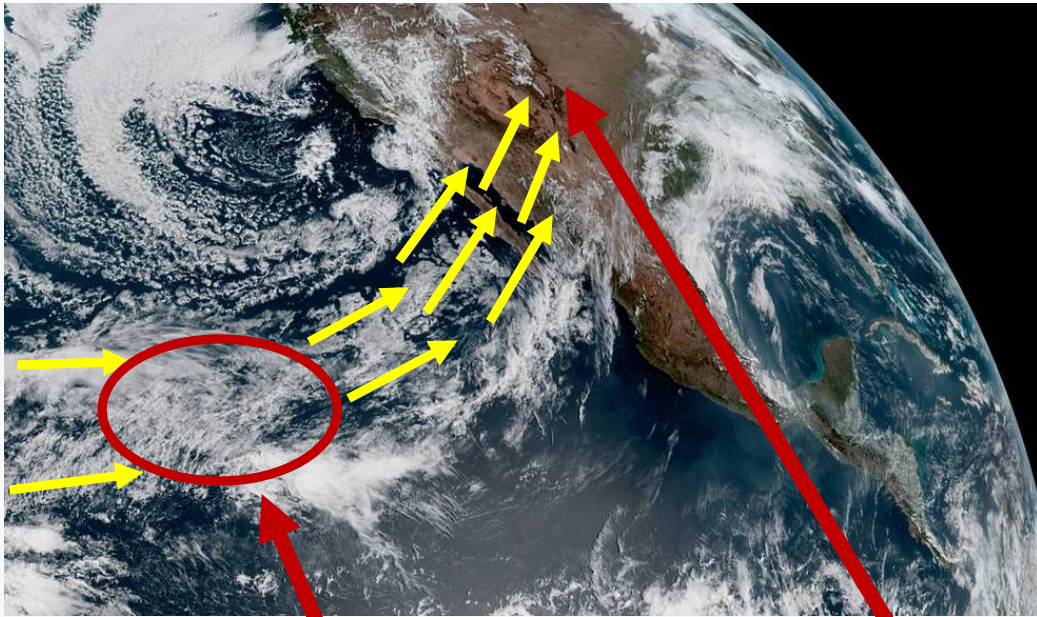
- Solar Panel Power Output, in 30 min.



We cannot see far enough from the ground for 30 min predictions.

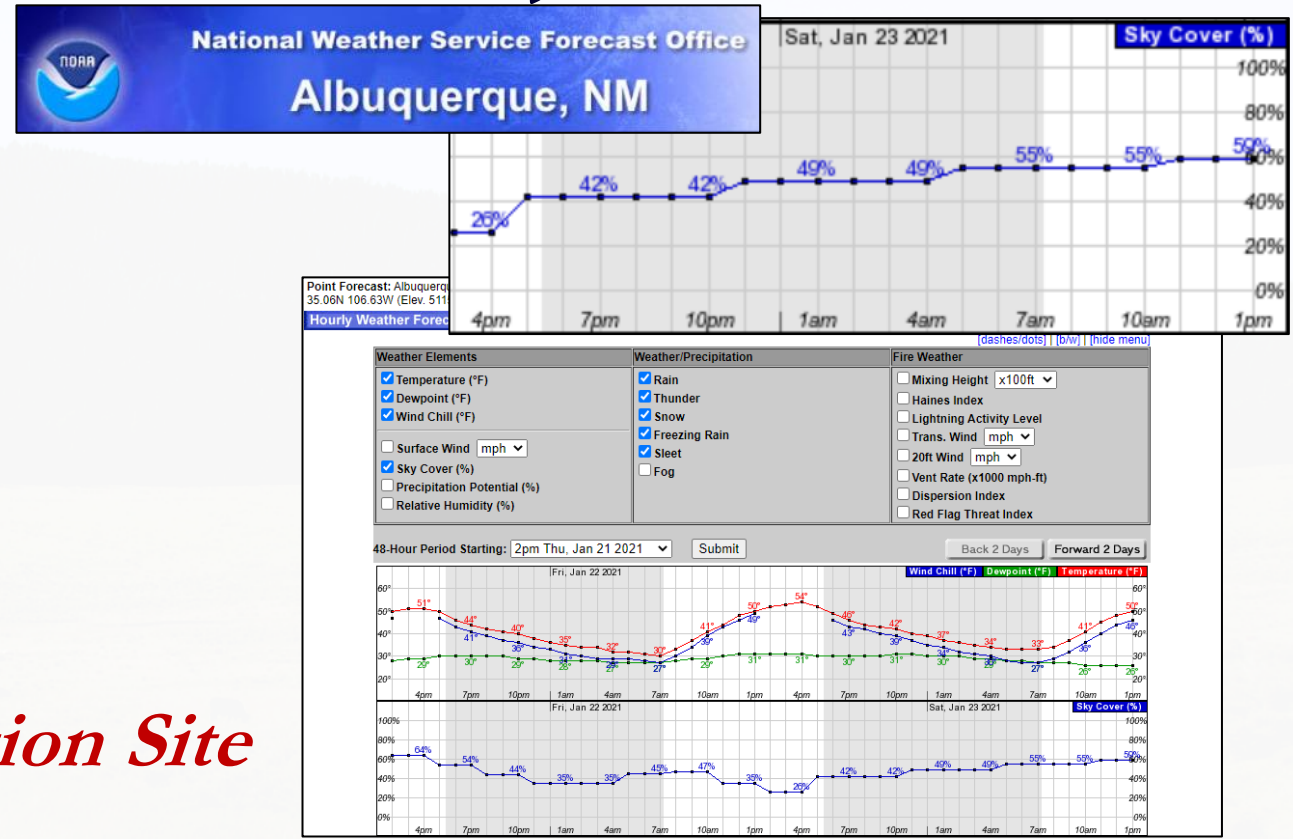


STV #3; Is it Sunny Over Solar Panels, Tomorrow?



Current Conditions

Prediction Site



A-Side

- Satellite Images
- Jetstream vectors
- Humidity of incoming air
- Others _____ ?



B-Side

- % Cloudiness in a region, each hour of the day

STV #4; Autopilot Crash Avoidance Inputs



crash, 8.5+ s.



Ivan (17.2m)*
18

Car (10.5m)
ID:44

Lane: Unknown
No Rad sig

Lane: Unknown
No Rad sig

Lane: Unknown
No Rad sig

- B-Side
 - Accelerate during next 1 s.?
 - Decelerate during next 1 s.?
- Notify Driver with beep, now: Y/N
- Other _____ ?, time period ____ ?

STV #4; Autopilot Crash Avoidance Inputs

time + 1 s.



time + 6 s.



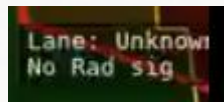
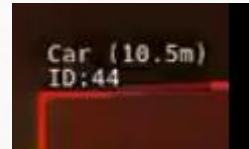
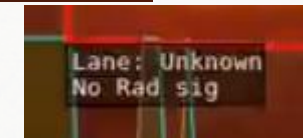
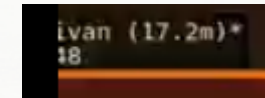
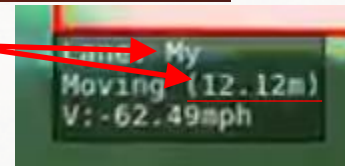
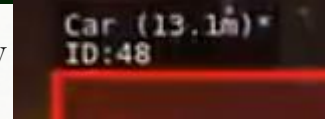
time + 8 s.



crash, 8.5+ s.



The AI correctly identifies the obstacle in the lane, & closing relative position. It still crashes.



A-Side

- Lane lines
- Distance of obstacle
- Type of obstacle (car/minivan)

A-Side, continued

- Relative obstacle velocities
- Relative obstacle position
- Relative obstacle accelerations
- Other _____?

Black Box, Algorithm

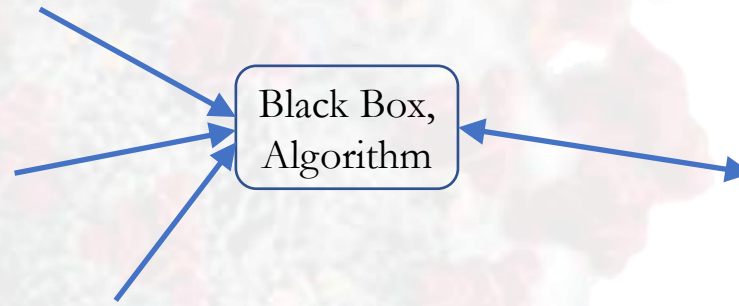
B-Side

- Accelerate during next 1 s.?
- Decelerate during next 1 s.?
- Notify Driver with beep, now: Y/N
- Other _____?, time period ____?

STV #5; Covid-19 & Infectious Agent Modeling

A-Side

- **Mobility Data, from cell phone movements**
- **Temperature**
- **Humidity**
- **Pre-existing conditions?**
- **Demographics**
- **Smoking habits?**
- **DNA data on the strain/person**
- **How much and when during the day, do they get sunlight?**
- **Other obtainable data: _____?**
- **Other non-obtainable data: _____?**



B-Side

- **'R' effective reproduction number in, Y number of days.**
- **Case Fatality rate in, X number of weeks.**
- **Hospitalization Probability %, in Z number of days.**
- **_____ other, in what time frame, if any?**

Note: The list is ordered from easy to difficult in obtainability.

STV #6; Blood Test to Predict Cancer

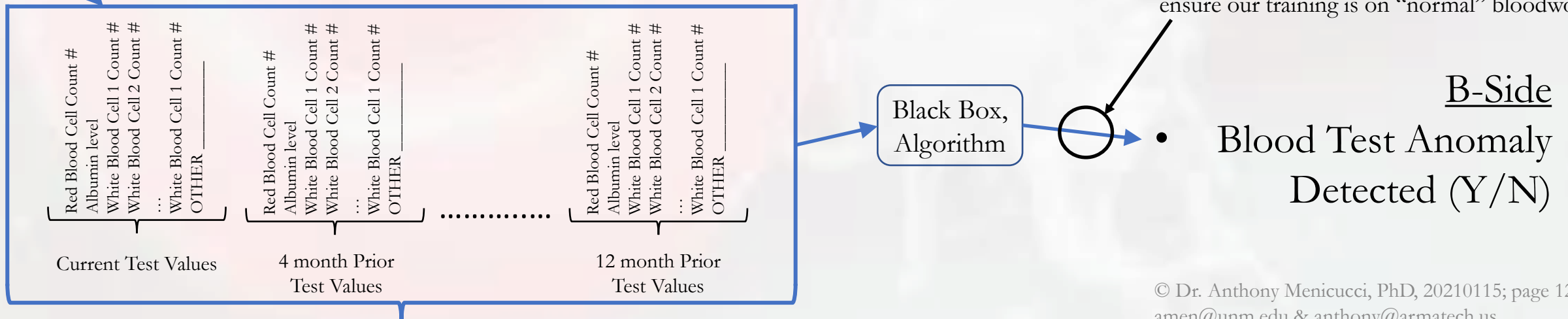
A-Side, Past * Number of Test Results

- Current & past * # of “Red Blood Cell Count” test values; normal ~4.2-6.1 million/microliter
- Current & past * # of “Albumin” test level values
- Current & past * # of “5 x White Blood Cell Counts” values
- Current & past * # of Coomb’s Tests
- Current & past * # of _____ OTHER test values

Three personal acquaintances almost quoted this EXACT phrase:

“I felt bad for 12 months before I was ever diagnosed with cancer.” “The blood test confirmed I had a medical problem.”

We do not need a confirmed cancer (Y/N) B side input to identify an anomaly. We only need to ensure our training is on “normal” bloodwork.



STV #7; Market Instruments

A-Side

- Capital Flows (Government, Institutional, Hedge Funds, Small, Robinhood; buying/selling...)
- Search Volume Index
- Total Delta/Gamma...
- OR Delta/Gamma at strikes...
- OR Delta/Gamma at strikes, weighted relative to the expiration date...
- Other obtainable data:
_____?
- Other non-obtainable data:
_____?

Black Box,
Algorithm

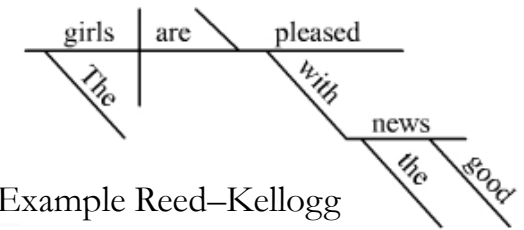
B-Side

- Volume,
in *, **, *** #Days/Yrs.
- Price (\$),
in *, **, *** #Days/Yrs.
- % Price
Increase/Decrease,
in *, **, *** #Days/Yrs.
- Other Prediction _____,
in *, **, *** #Days/Yrs.

AI Text Inputs

1. Use a Lexicon to map words into unique identifiers, like barcodes (8 character long binary representations of 1's and 0's).
2. Then select the number of input segments for the A & B side.

A Lexicon is defined as a dictionary of terms in common usage.



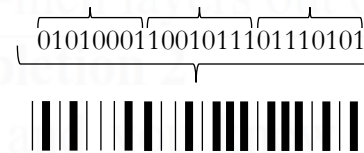
Example Reed-Kellogg sentence structure Diagram

Lexicon

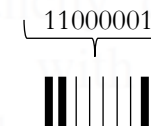
creep *Creep* is one of an interesting class of English verbs having a long vowel in the infinitive and a short one in the past and past participle. In Middle English

head over heels Part of the appeal of this adverbial phrase suggesting a somersault is its lack of logic; the head is, after all, normally over the heels. The original phrase was *heels over head*, which was recorded as early as the 14th century. The variant *head over heels* has

other than *Other* has a propensity for being used with *than*. The trouble is, as the OED shows, that *other* can be an adjective, a pronoun, or an adverb, and still be used with *than*. This flexibility has created a variety of *other than* constructions and the consequent bewilder-



Black Box, Algorithm



The algorithm will learn the above structure, if and only if, it was properly trained. "Twitter Training" will not help train in logic and/or grammar.

STV #8; News Generator AI Inputs

A-Side 1

In a shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English.



A-Side 2

a shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English. **The**



A-Side 3

shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English. **The scientist**



Context (human-written):

In a shocking finding, scientist discovered a herd of unicorns living in a remote, previously unexplored valley, in the Andes Mountains. Even more surprising to the researchers was the fact that the unicorns spoke perfect English.

GPT-2 [AI written]: The scientist named the population, after their distinctive horn, Ovid's Unicorn. These four-horned, silver-white unicorns were previously unknown to science.

Now, after almost two centuries, the mystery of what sparked this odd phenomenon is finally solved.

Dr. Jorge Pérez, an evolutionary biologist from the University of La Paz, and several companions, were exploring the Andes Mountains when they found a small valley, with no other animals or humans. Pérez noticed that the valley had what appeared to be a natural fountain, surrounded by two peaks of rock and silver snow.

Pérez and the others then ventured further into the valley. "By the time we reached the top of one peak, the water looked blue, with some crystals on top," said Pérez.

Pérez and his friends were astonished to see the unicorn herd. These creatures could be seen from the air without having to move too much to see them – they were so close they could touch their horns.

While examining these bizarre creatures the scientists discovered that the creatures also spoke some fairly regular English. Pérez stated, "We can see, for example, that they have a common 'language,' something like a dialect or dialectic."

More News Examples From the GPT-3 Clusters, 2020

This Algorithm Mastered “grabbing reader’s attention”

A-Side Primed
Human-Written
Input to the
GPT-3 Text-
Generator
Algorithm is in
gray

*Note that
approximately 4
out of 10 the
people sampled,
believed this
story was written
by a human.*

Title: Star’s Tux Promise Draws Megyn Kelly’s Sarcasm
Subtitle: Joaquin Phoenix pledged to not change for each awards event
Article: A year ago, Joaquin Phoenix made headlines when he appeared on the red carpet at the Golden Globes wearing a tuxedo with a paper bag over his head that read, "I am a shape-shifter. I can't change the world. I can only change myself." It was a promise to not change to fit into the Hollywood mold: "I think that's a really special thing, to not change yourself. I think it's a really special thing to say, 'This is what's inside of me, I'm proud of it, and I'm not going to be ashamed because of the way that someone else thinks I should be.'" Now, it's the Oscars, and Phoenix is at it again. But this time, his publicist is saying he'll be wearing a tux no matter what. Megyn Kelly was not impressed, and she let him have it on The Tonight Show. "You know, I feel like, I feel like you could have worn the tux," she says. "But you're saying you're a shape-shifter. I don't know if you can change your tux, but you can change your mind. You can change your mind. You can change your mind." Phoenix says he did, but it didn't stick. "I was like, 'Okay, I'm going to wear a tuxedo to this thing.' And then I thought, 'I don't want to wear a tuxedo to this thing.'" Kelly goes on to encourage him to change his mind again, but Phoenix says it's too late: "I'm committed to wearing this."

Figure 7.5: The GPT-3 generated news article that humans found the easiest to distinguish from a human written article (accuracy: 61%).



Joaquin
Phoenix,
Joker
(2019)

B-Side “News” Article
Written by the Text-Generator
Algorithm is in black.

1. *Assuming Joaquin Phoenix was pulling a stunt;*
2. *Not paying attention past the first few sentences &;*
3. *Being a fan of the Movie Joker (2019);*
4. *Therefore: Is it more understandable how 4 in 10 random people believed the article was written by a human and possibly real?*

The above excerpt was taken from: T. Brown, B. Mann, N. Ryder, et al.; “Language Models are Few-Shot Learners,” May, 2020

Baking Mint Cookies With GPT2 Algorithm, 2019

A-Side Primed Human-Written Input to the GPT-2 Text-Generator Algorithm

Context (WebText test)

Aaron loves mint chocolate cake, but he requires that it be paired with mini chocolate chips, so I threw some of those in between the layers. I also had a few Peppermint Jo Jos on hand so I crushed them up and threw some of those in along with some crushed meringue cookies because, why not? It's a total smorgasbord of minty chocolate chippy cookie crunchy goodness. I didn't measure how much of each topping I used, but after I tasted the finished product, I wish I had added more. You can add anything you want- crushed candy canes, peppermint bark, etc. And don't be afraid to use a heavy hand. Texture = good.

If you don't have 7-inch cake pans, you can get 3 shorter 8-inch layers out of this

GPT-2 Completion 4

recipe.

Meringue Cookies

1 3/4 cup butter, softened
1 cup sugar
1 egg yolk
3 T. heavy cream
3 1/2-4 cups flour
pinch of salt
Peppermint-Jojo Topping
1 1/4 cups powdered sugar
1 cup chopped pecans
1/2 cup finely chopped mint leaves
1/2 cup chopped fresh mint (about 1/2 sheet)
1 tsp. peppermint extract
1/4 tsp. sea salt
pinch of sea

GPT-2 Completion 5

recipe.

My 2 failures at Christmas morning were not due to poor frosting skills. That was another success story. The cake was beautifully moist, and well, just a beautiful cake. It's got very little air in it or moisture, but all the chocolate and mint was perfectly blended together.

One thing that made me cringe a bit was that all those ingredients- egg yolks, sugar, melted butter, chocolate chips, melted chocolate, and mint- had to be mixed right into the cake batter, which is super time-consuming. A friend suggested that if I put the batter in a separate bowl, I

The above and left excerpt was taken from: A. Radford, J. Wu, R. Child, D. Luan, D. Amodei, I. Sutskever; "Language Models are Unsupervised Multitask Learners," 2019, Open AI, San Francisco, California, United States

B-Side, 2X

These are two recipes were written by a Text Generator Algorithm.

Completion #4 seems like a recipe candidate, but fails to detail an ingredient combination and baking procedure.

Completion #5 reads more like a Twitter post than a recipe.

STV #9 Auto-Caption



PowerPoint Auto-Caption:
“A dog wearing a costume”

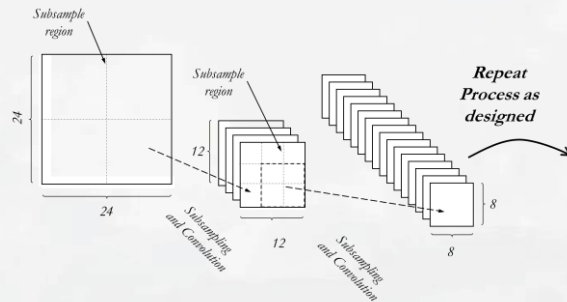
Human Written Caption:
“Now that you’re dressed, get to work with that mop. It’s in back of you.”



PowerPoint Auto-Caption:
“A dog standing on top of a sandy beach”

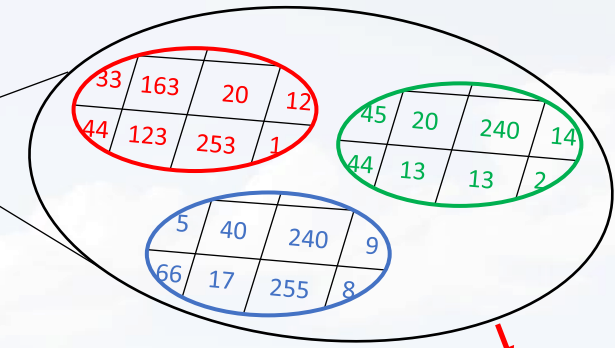
Human Written Caption:
“If this is a sandy beach, I have the deal of a lifetime, for you!”

Convolution artificial neural network showing the first two layers



PowerPoint Auto-Caption:
“A dog lying on a table”

Human Written Caption:
“That mess won’t clean itself up!”

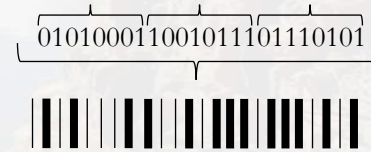


A-Side

- Red(x,y) value 0-255
- Green(x,y) value 0-255
- Blue(x,y) value 0-255

Black Box, Algorithm

B-Side
 Multiple word caption



A Closer Look at Humor Inputs, Non-Existent in 2021



PowerPoint Auto-Caption:

“A picture containing refrigerator, indoor, person, cabinet”

Human Written Caption:

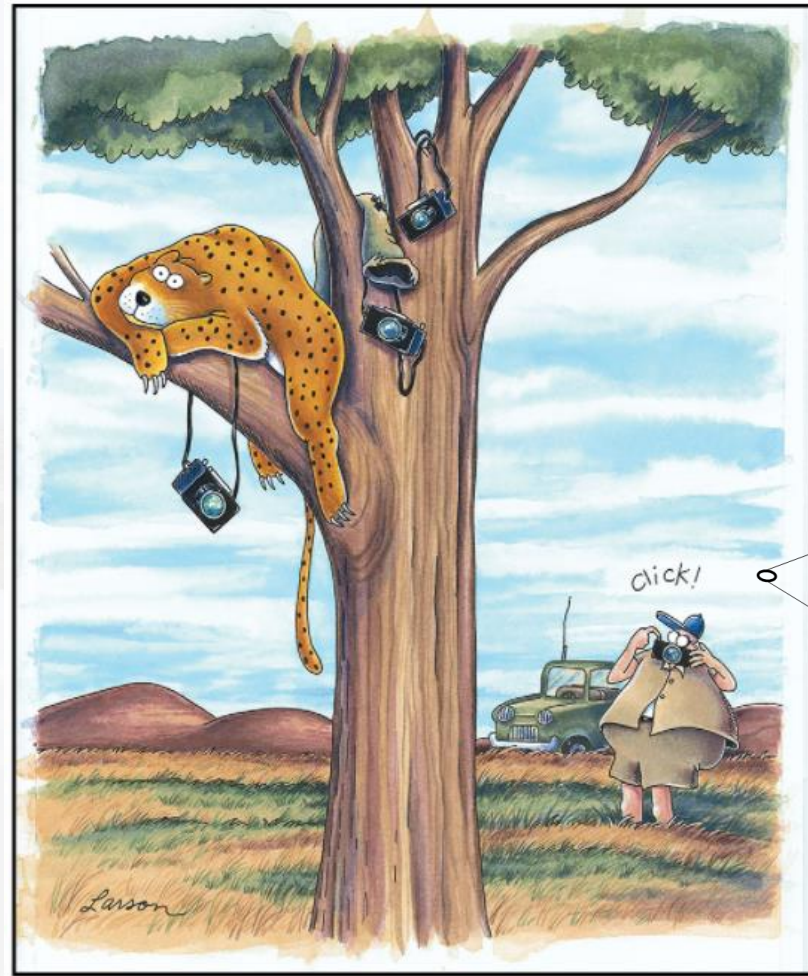
“If you are going to leave the door open, can I have the rest of this milk, before it goes bad?”

or

“If you give your friend a cookie...”

or

“When your friends are alone for more than 90 seconds.”



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The Far Side®, by Gary Larson, All In the Phylum, December 28, 2020;

<https://www.thefarside.com/collections/210/animals-all-the-phylum-dec2020>

Propose: Use Scott Adams’ Six Dimensions of Humor & Language Lexicon inputs:

- Naughty -> |||
- Clever -> ||
- Cute -> |||
- Bizarre -> |||
- Mean -> |||
- Recognizable -> |||

A-Side, The Far Side® Example:

- ||, |||, ||| ;
- “Safari”,
- “Camera”,
- “Dumb”,
- “Tourist”,
- “Sleeping”,
- “Cheetah”,
- “Tree”,
- _____ other?

Humor Context

Translate with Lexicon before input, like above

B-Side

- Red, Green, & Blue, values (0-255) for each (X,Y) pixel location

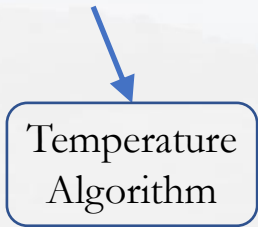
Comic-Bot Algorithm

STV #10; Temperature in 10^9 - 10^{10} Years & 10^{-6} seconds

Temperature in 10^{-6} seconds

A-Side

- Temperature is a function of atoms and internal energy in $\sim 10^{-6}$ seconds.
- Need Particle Physics Inputs



Standard Model of Elementary Particles			
three generations of matter (fermions)			Interactions / force carriers (bosons)
I	II	III	
u up +2.2 MeV/c ²	c charm +1.28 GeV/c ²	t top +173.3 GeV/c ²	g gluon +124.87 GeV/c ²
d down +4.7 MeV/c ²	s strange +96 MeV/c ²	b bottom +4.18 GeV/c ²	γ photon
e electron +0.511 MeV/c ²	μ muon +105.66 MeV/c ²	τ tau +1.7768 GeV/c ²	Z Z boson +91.187 GeV/c ²
ν _e electron neutrino +1.0 eV/c ²	ν _μ muon neutrino +1.17 MeV/c ²	ν _τ tau neutrino +1.7 MeV/c ²	W W boson +80.385 GeV/c ²
LEPTONS			SCALAR BOSONS Higgs
QUARKS			VECTOR BOSONS

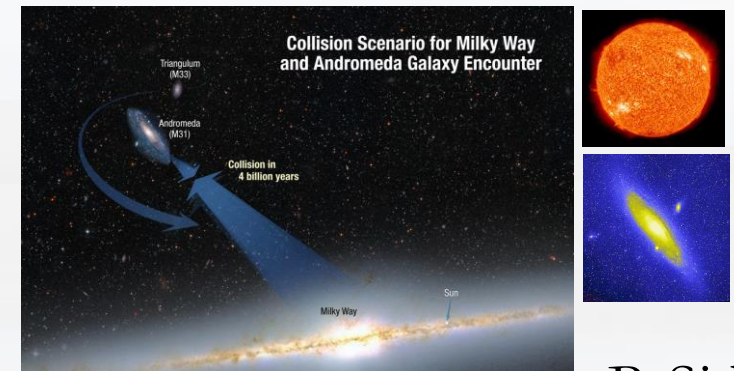
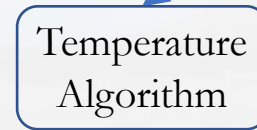
B-Side

- Temperature prediction as a function of atomic energy in the next 10^{-6} seconds
- Other _____?

Temperature in 10^9 to 10^{10} Years

A-Side

- Temperature on earth is a function of the sun & possibly the Galaxy/s in $\sim 10^9$ years
- Need Astronomy Inputs

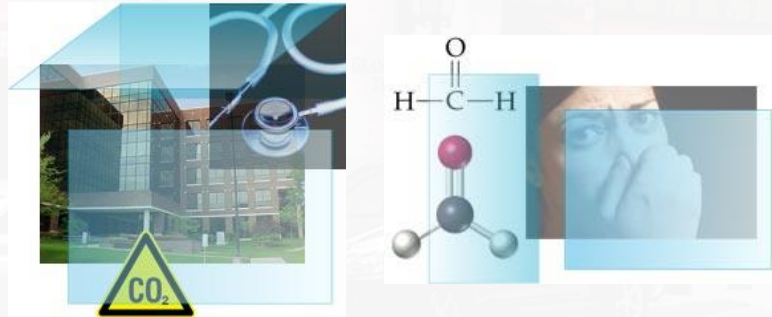


B-Side

- Temperature prediction as a function of Andromeda collision in 4 Billion years & our sun's existence, in the next 10^9 years
- Other _____?

STV #11; HVAC Functionality, SBS Example

Sick Building Syndrome (SBS) *Is a medical condition where people in a building manifest symptoms of illness or unwellness, for no apparent reason. The symptoms increase in severity with the time people spend in the building. Symptoms in persons who limits their building exposure time, will generally disappear when they are not in the building and reappear when re-exposed to inside building air.*

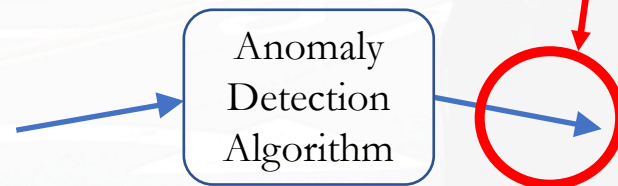


Hypothetical Primer for Cause & Effect Analysis with Limitations:

1. Stagnant air causes a buildup in humidity;
2. Excessively humid air causes bacterial growth;
3. Stagnant air causes excessive CO₂ & other gas buildup;
4. We do not have humidity, temperature or CO₂ building sensors.

A-Side

- Hourly energy usage compared to last year, last week, yesterday...
- Hourly energy usage compared to outside temperature...
- Other _____ ...



Note: 1. We do not need a confirmed SBS input to identify an anomaly. We only need to ensure our training is on non-sick buildings.

B-Side

Note: 2. We imply, accurately or not, an air handling motor, somewhere, is not delivering fresh air to the building.

- Anomaly Detected (Y/N), NOW
*no further information available, recommend building walkdown to identify cause of anomaly

Final Exam on Inputs

Driverless Taxi



Driverless taxicab, "JOHNNYCAB" from the movie, Total Recall (1990)

Driverless Waste Collection



From an inputs standpoint; What is the difference between automating a taxi route vs. automating a waste collection route?

Answer: Taxi routes are chaotic, irregular & hard to learn. Waste collection routes are methodic, predictable & memorizable.

Thank You

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