Data and Society

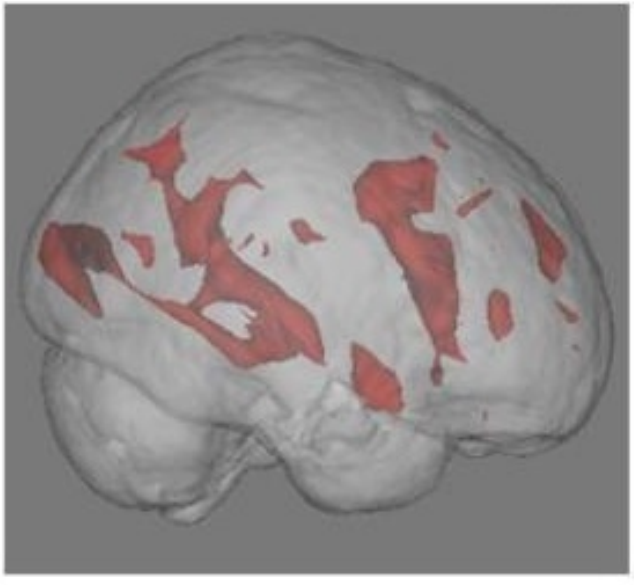
Resources and Dangers and Opportunities

Kenneth W. Regan

(Includes material from Kenny A. Joseph and some other past CSE199 units.)

CSE199, Fall 2024

Main Problem...



THIS IS YOUR
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ON THE INTERNET

Any Questions?

(Brain scan source, 1987 PSA source)

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- How does that compare (in speed and mass) to "Memes" and viral content today?

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- Even nearer term: Elon Musk's **Neuralink** brain implant as used to play chess.

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- **Actual reality**: the July 19, 2024 CrowdStrike Crash.

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- Your further CS education will show how to build systems from the ground up.

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- **Datasets from the past have large racial and socioeconomic biases.**

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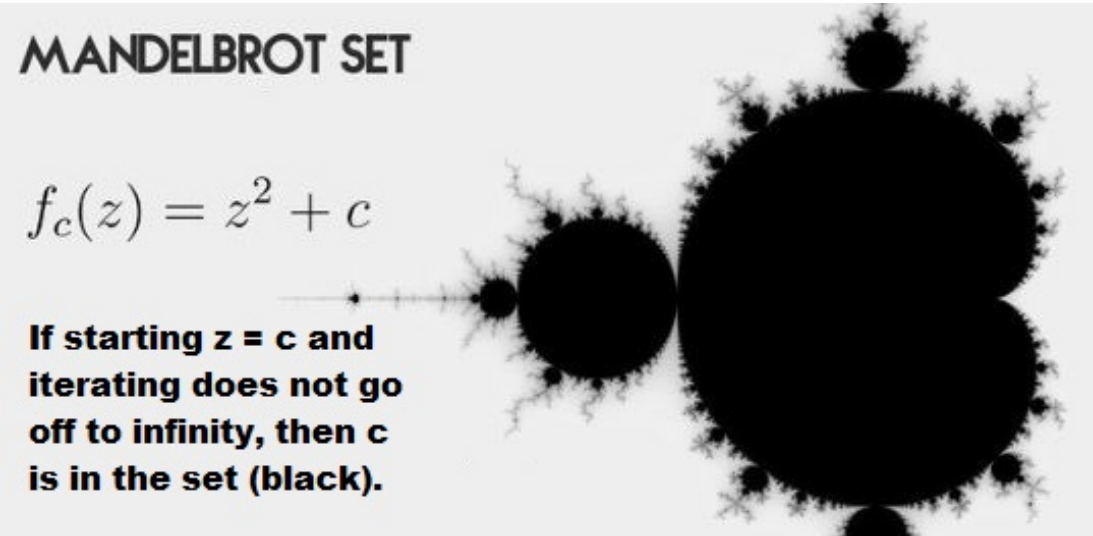

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- Whether the info and inferences are **true** is secondary!

Outline For Remaining Lectures

1. Some further remarks about Data as time allows in this lecture.
2. Our Global Data Village
3. Data Analytics, Search, and AI
4. AI, continued—Project Ideas
5. Societal Computing and Fairness
6. Synthesis.

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- The Internet Archive Wayback Machine has indexed over **866 billion** webpages.

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But for many users, where it lives virtually is in the Cloud.

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- Many data centers are augmented with **server farms** to do the processing.

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- **Doing so front-loads material for both this week's activity and next week's homework.**

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- Rock-Paper-Scissors is a simpler example with *simultaneous play*.
- Describable as a **single-matrix game** like so:

You\Oppt.	Rock	Paper	Scissors
Rock	0	−1	1
Paper	1	0	−1
Scissors	−1	1	0

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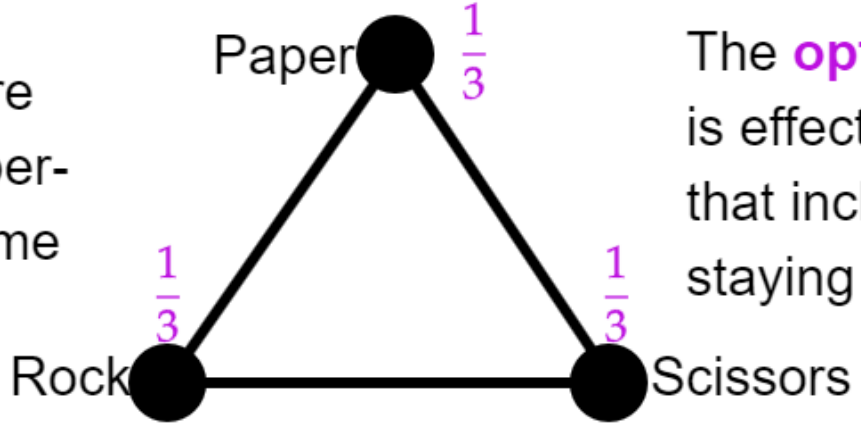
- Only foolproof way: a **completely random** strategy. Here: roll a die and play Rock on 1 or 2, Paper on 3 or 4, and Scissors on 5 or 6.
- But since this is a **fair game**, you can't expect to win either.

Graph picture of Rock-Paper-Scissors game



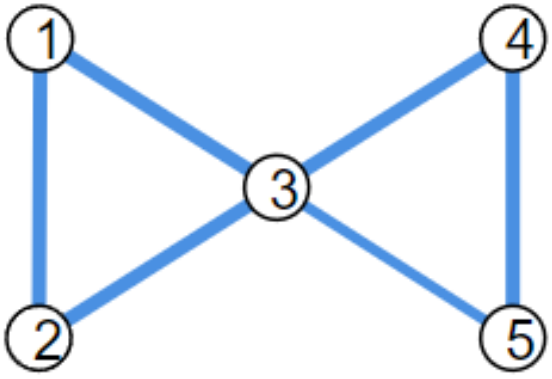
The **optimal random strategy** is effected by a **random walk** that includes the option of staying on your **current node**.

Another Single-Matrix Game

Imagine hunting a polar bear on ice floes in Arctic fog. When fog lifts:

- If hunter and bear are on adjacent floes, hunter shoots bear: $\rightarrow +\mathbf{1}$.
- If the bear is 2 or more floe-jumps away, the hunter misses: $\rightarrow \mathbf{0}$.
- If they find themselves on the same floe, $\rightarrow$ **?**.

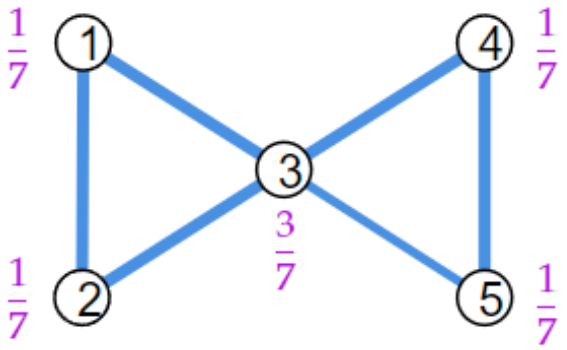
The network of adjacent floes can be represented as both a discrete graph and a matrix. Here is a picture of the game when five floes are arranged in a "bowtie" pattern:



You \ *Bear*	1	2	3	4	5
1	?	1	1	0	0
2	1	?	1	0	0
3	1	1	?	1	1
4	0	0	1	?	1
5	0	0	1	1	?

Bowtie Graph Game—Continued

If **? = 0** then the hunter achieves **expected value** $v = \frac{4}{7}$ by adopting the randomized strategy shown.



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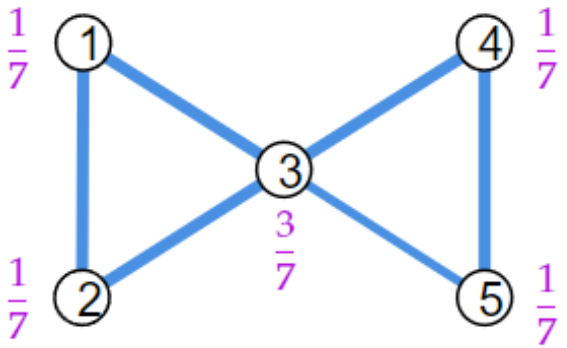

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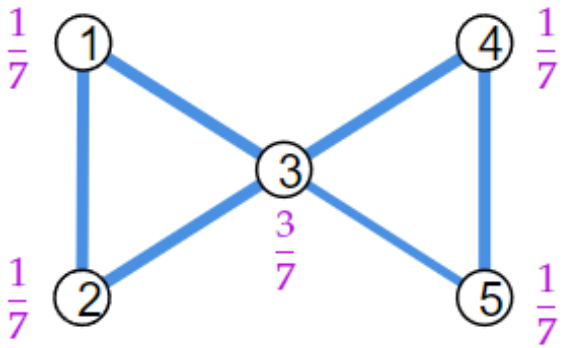

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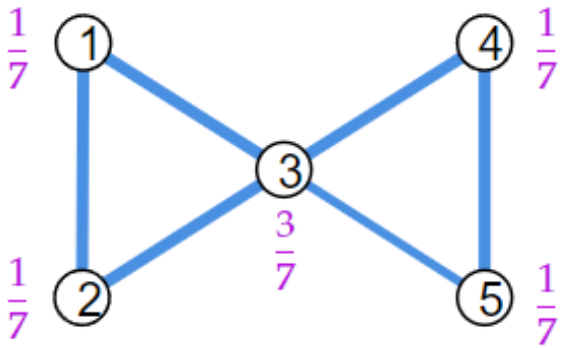

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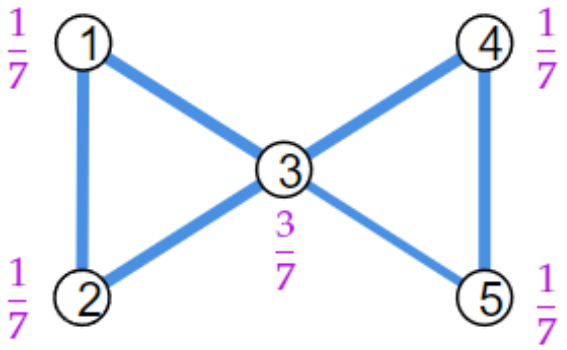

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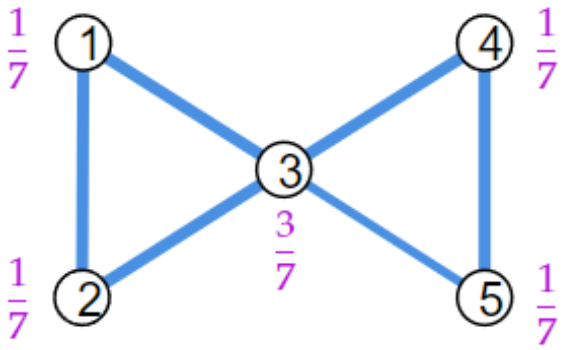

	1	2	3	4	5
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The "same" strategy by the bear assures losing no worse than $v = \frac{4}{7}$.

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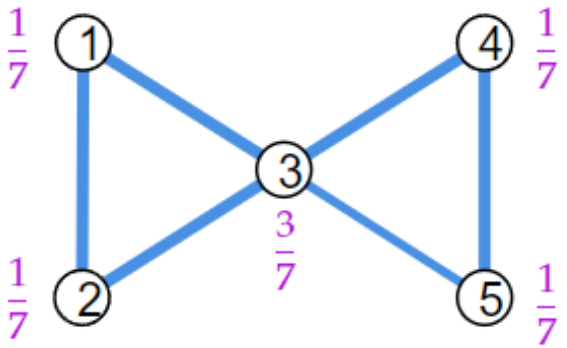

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- If **? = -1** then $v = \frac{1}{3}$ and both hunter and bear play (3) one-third of the time—same frequency as in a **random walk** of the graph.

Two-Matrix Games: Not Zero-Sum

Change the same-floe case to be: bear knocks the gun away but raids the hunter's lunch for **+3** value rather than kill em. Meanwhile the hunter videos the bear, for **+0.5** value. And in the two-floes-away case, let's penalize both of them **-0.5**, for missing and being inadvisably close. Now we need a separate **payoff matrix** for each:

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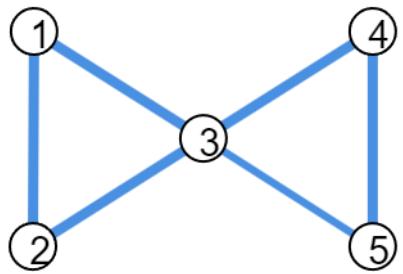

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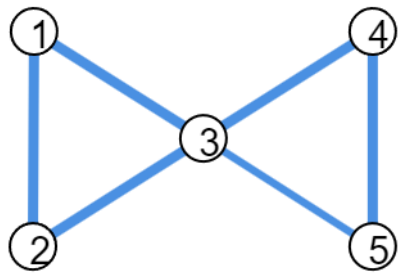

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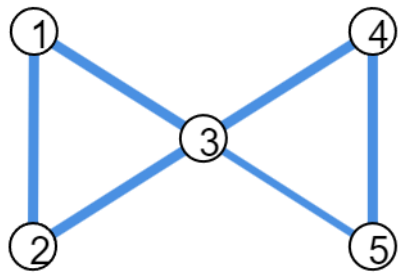

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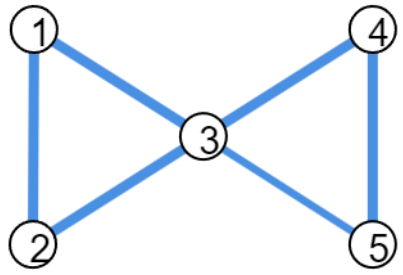

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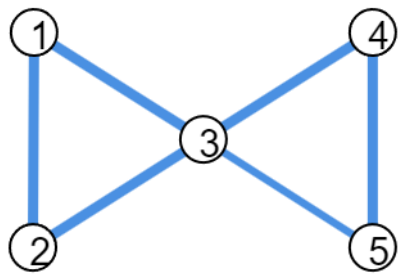

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- **Internet Search** is a solitaire game where the payoff to you is the *non-quantified* usefulness of the found pages to you.

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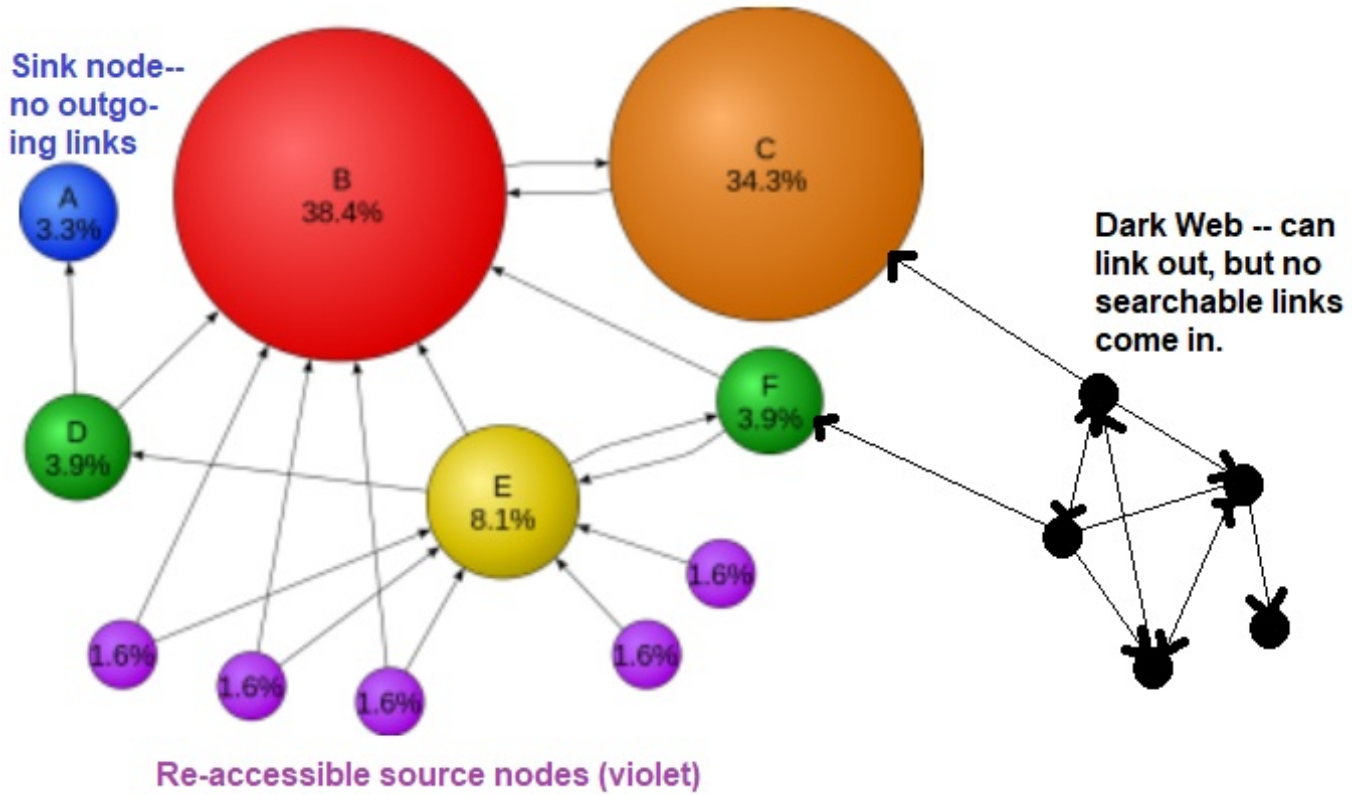

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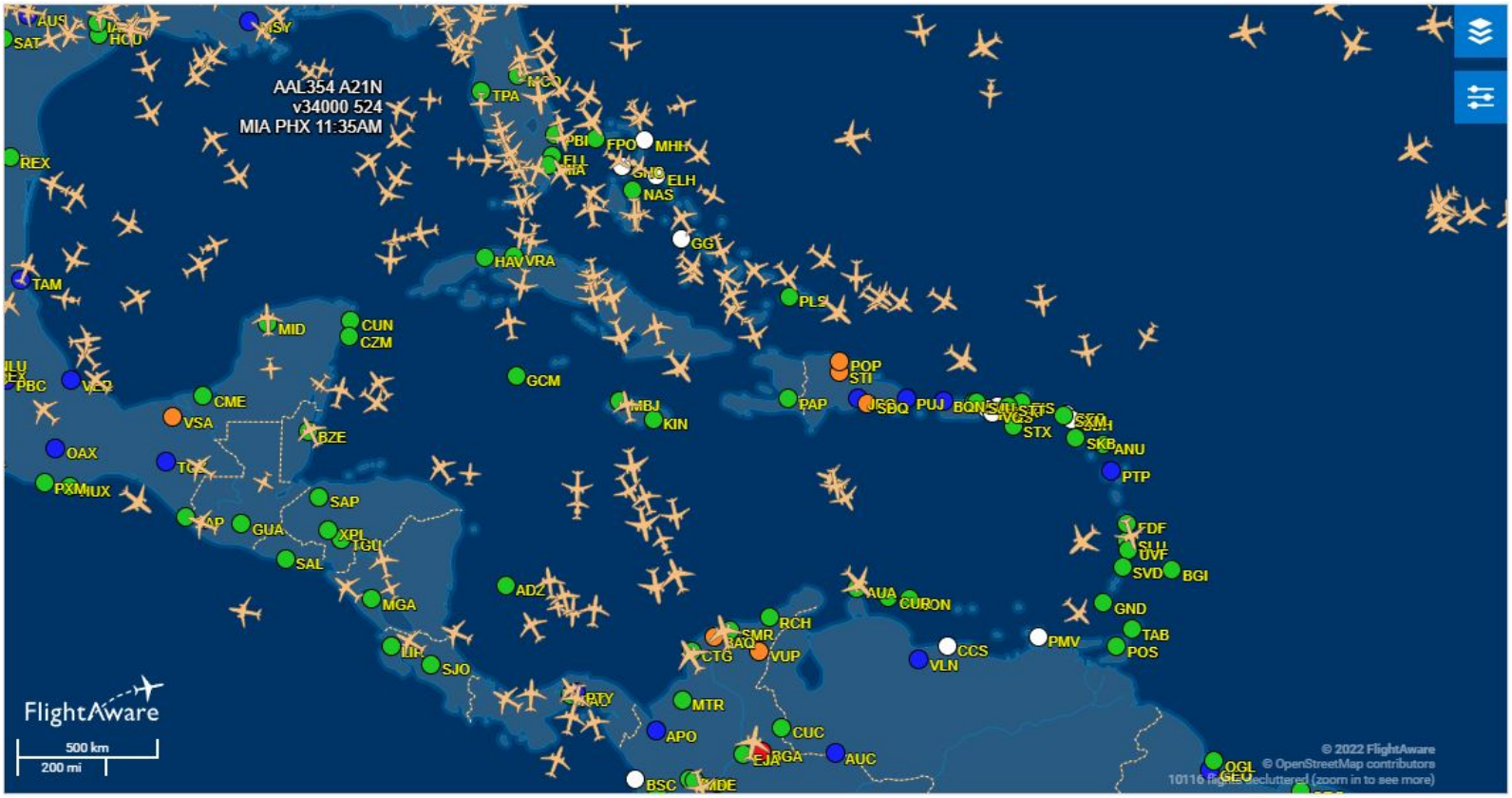
A "Semi-Structred" Example (of Inferencing)

FlightAware Live Tracker, Monday 9/19/22, about 11am:



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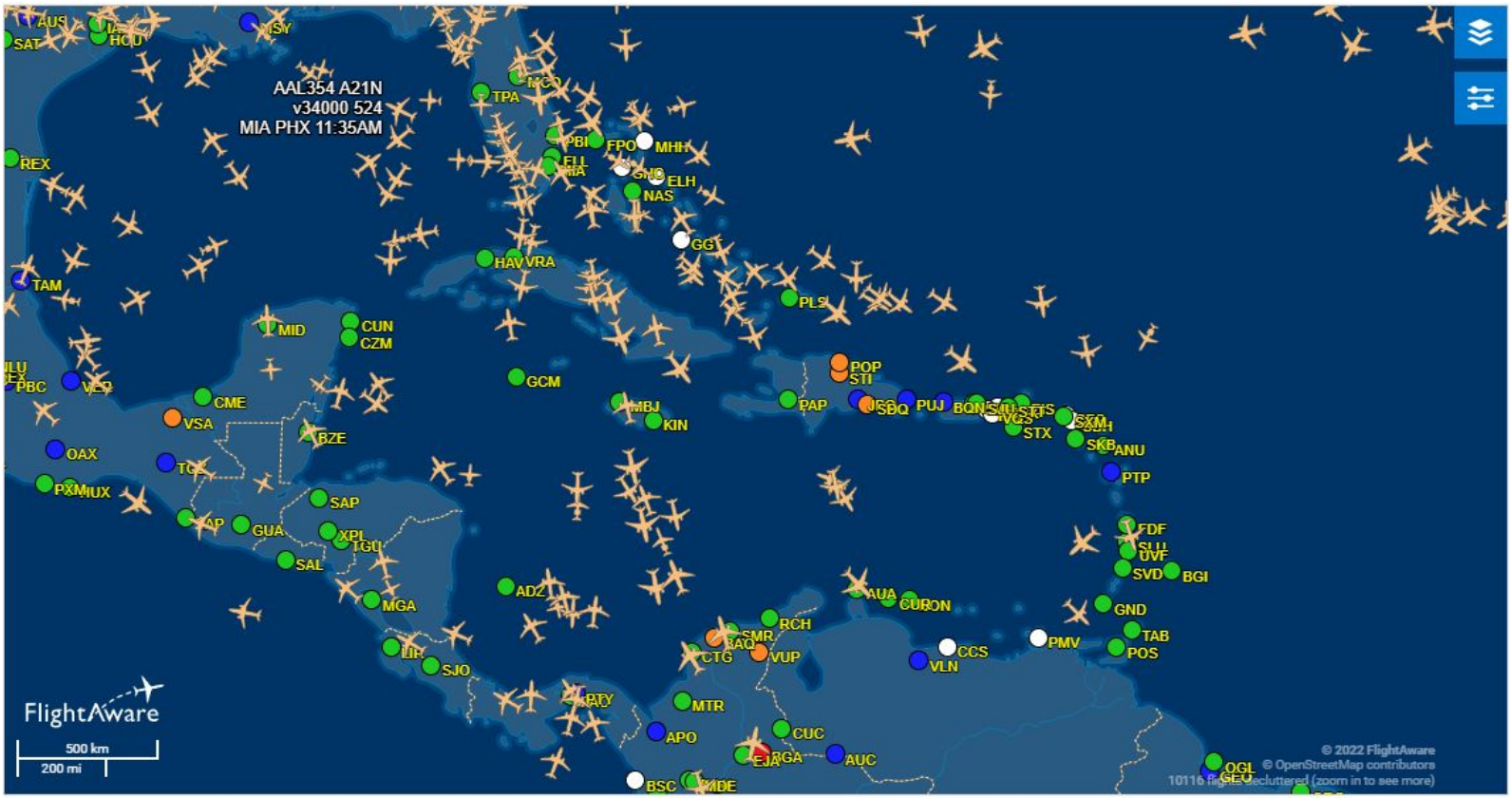

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And what about north of the Black Sea?

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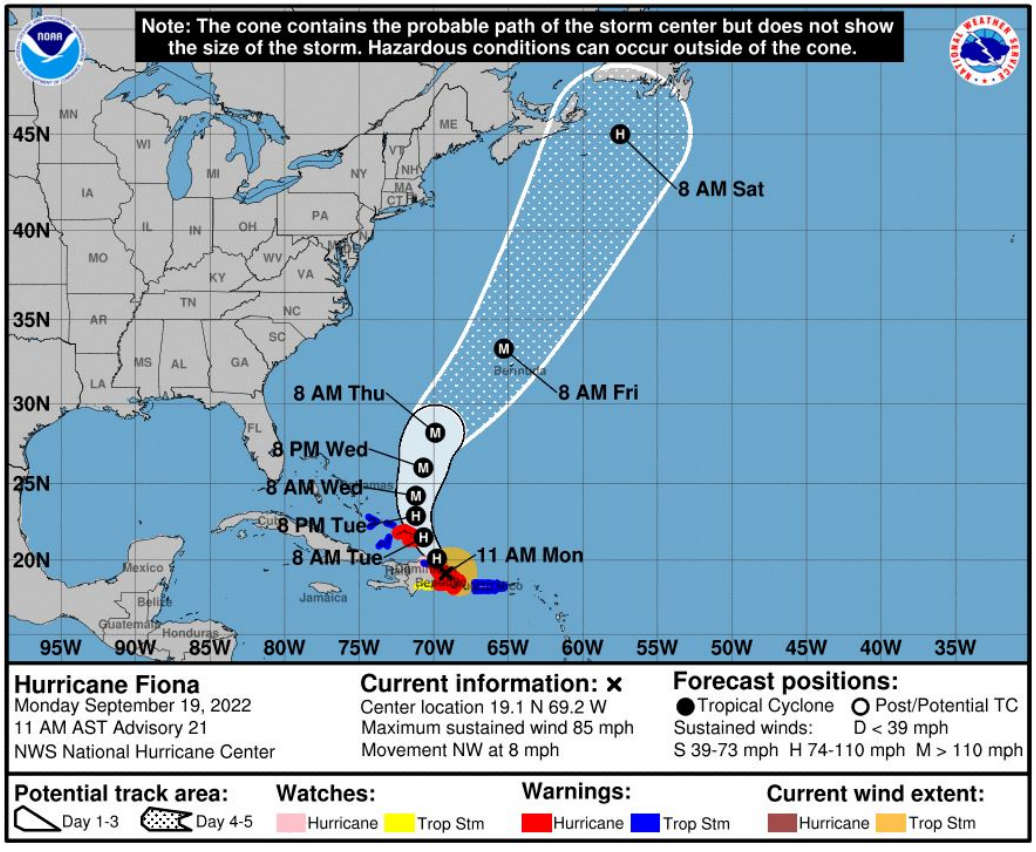

Note the error bars around the forecasted track.

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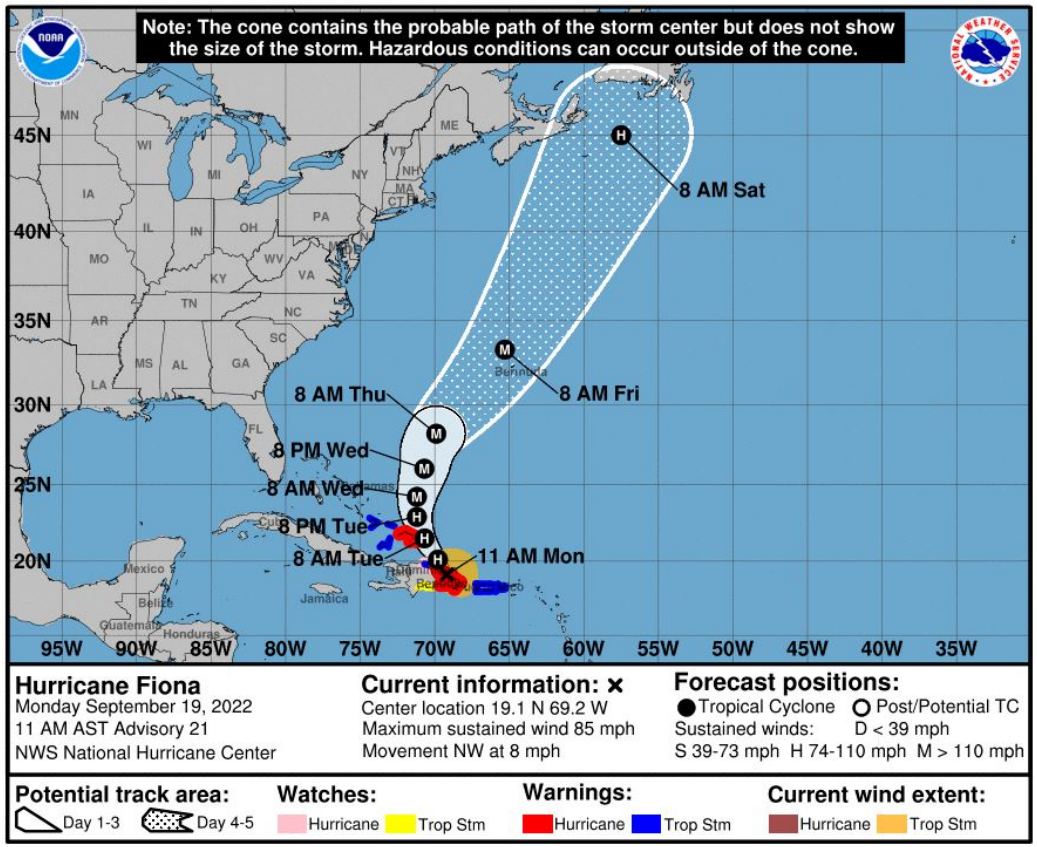

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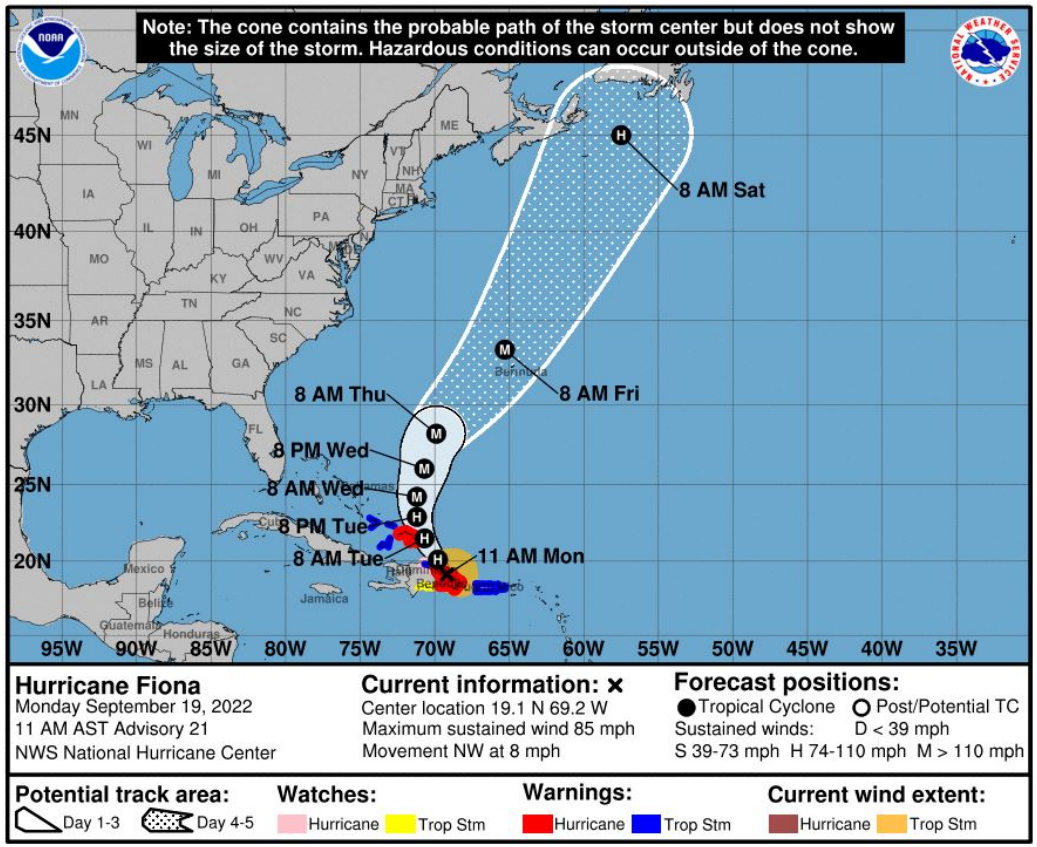

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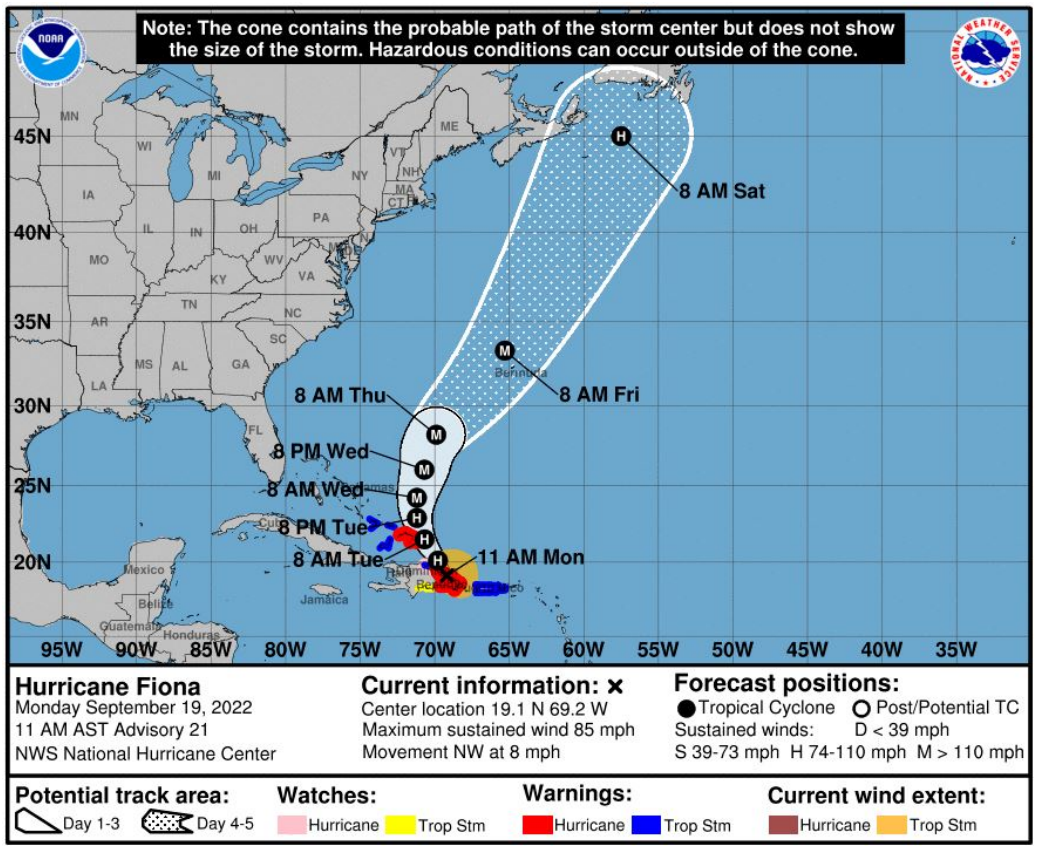

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- Part of **OSINT**: Open-Source Intelligence.)

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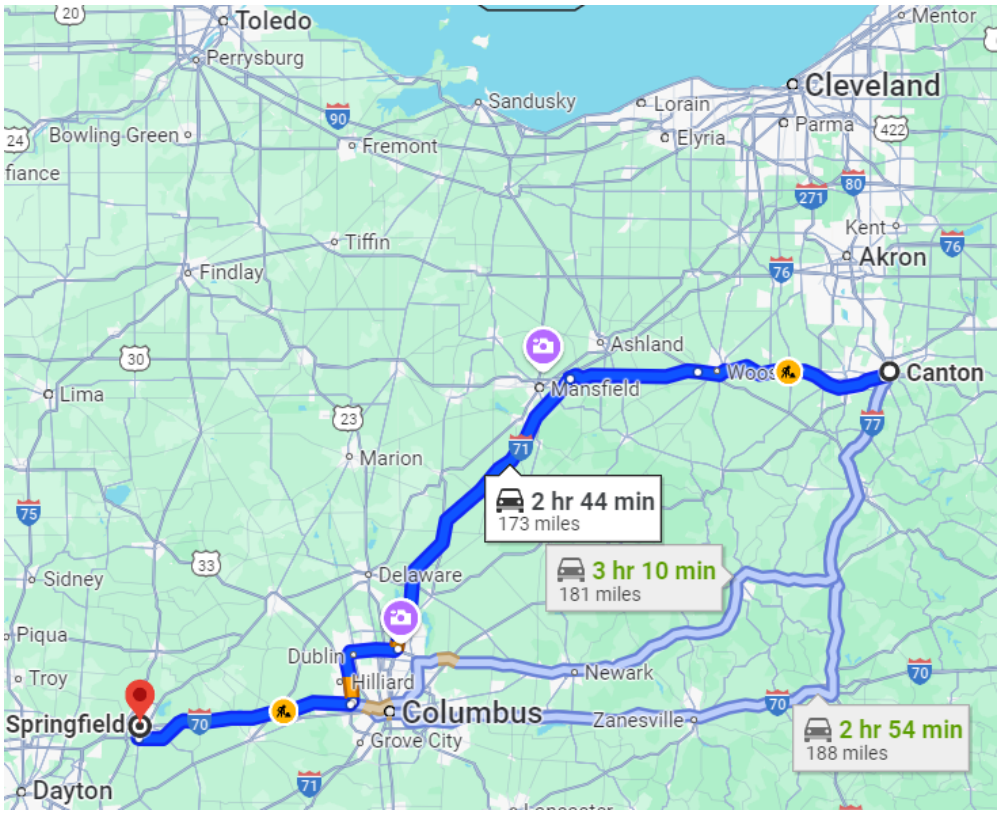
- Reports of lost pets in Springfield coming now—more than usual?



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- Look at all these public datasets!

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- (Silly new example of correlation-versus-causation: do the KC Chiefs lose when Taylor Swift isn't at the game? Madden '24)

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> Data in XML headers and in `<tag ATTR=...>` attributes

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- For misuse of Bram Cohen's BitTorrent—not so clear. Cut deal in 2005 with Motion Picture Association of America to follow DMCA.