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COUNTY ROAD
ADMINISTRATION BOARD

Using AI Today & Where It Can Take Your County Tomorrow

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** This presentation contains AI generated images.*

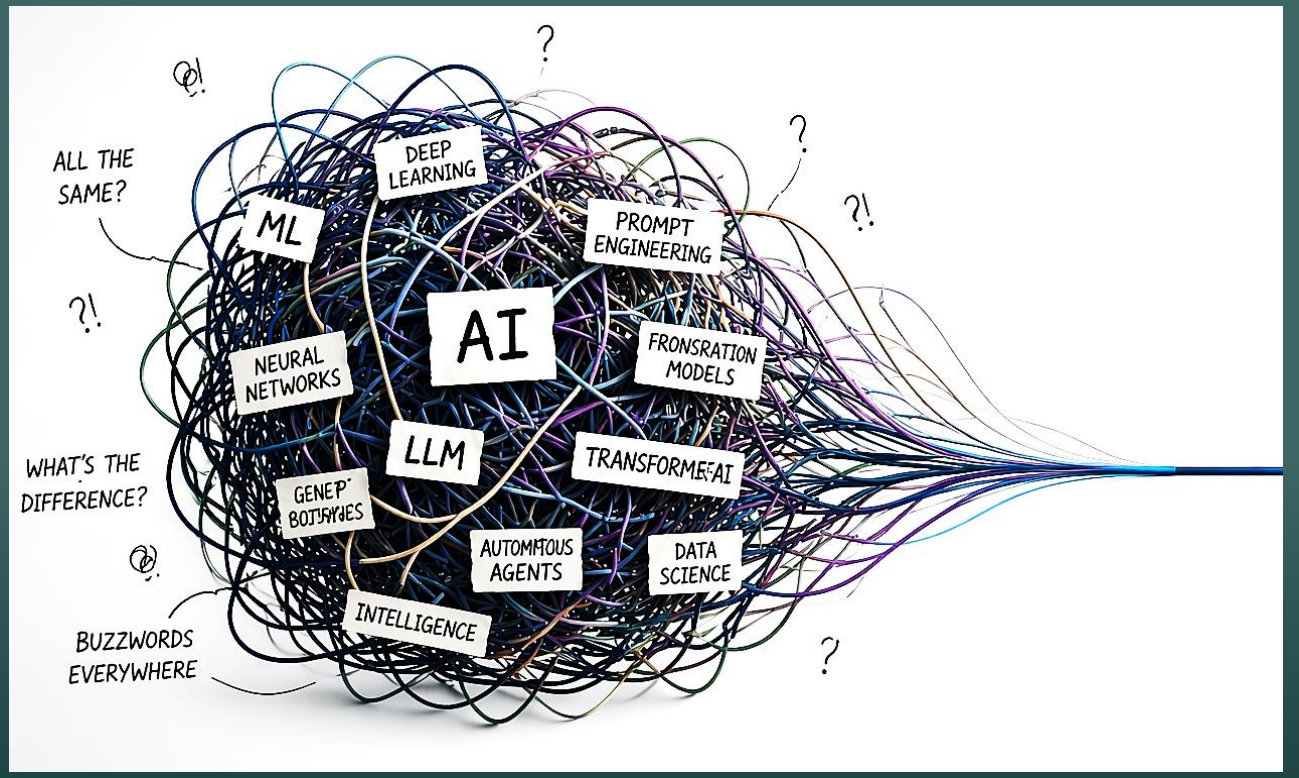


Objectives

- Develop a basic knowledge of the history, types, uses & limitations of AI as a tool.
- Understand CRAB's role in providing technical guidance to counties using AI.
- Identify how other agencies are using AI.
- Outline multiple ways that counties could incorporate AI into their transportation work.



Caveats



- AI as a topic has reached a very convoluted state.
- Terms are being bleached, blended, and misused.
- I'm knowledgeable – I am NOT an expert.
- I'm going to over-generalize for the sake of initial understanding.
- There's a fair chance you will hear or read something about AI that doesn't quite match what's presented here. If you do, please bring it to my attention at the end so that I can adjust my knowledge or clarify the source you found.

What AI is **NOT**

- AI is not conscious.
- AI does not reason or comprehend meaning.
- AI has no will or intentions.
  (Thus, it has no desire to take over the world – it is not Skynet 😉)
- (Generative) AI results are usually not EXACTLY reproducible.
- AI is not imaginative in the way humans are
  (it just blends already existing things).*
- AI is not objective. It cannot think for itself.

  It reflects the bias of its training materials

  AND its prompt…It is easily led.



What AI **IS** (More or Less)

Contemporary AI Systems…

…are statistical/predictive systems built on neural networks and trained on ridiculously large amounts of data – often millions or even billions of examples.

…involve statistical pattern recognition. It predicts the likelihood that something is of X pattern. It can operate on images, sounds, systems, and anything else it is trained on.

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Basic Categories of AI

AI is a broad term going back decades that covers systems which mimic human-like decision processes. These can be categorized in a number of ways…We will use four.

1. Classical (or Deterministic) AI
2. Machine Learning (ML)
3. Generative AI
4. Agentic AI

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Basic Categories of AI: Classical

Older AI systems that are deterministic logic maps that use hard-coded control (e.g. if-then) statements that map out possible decisions.

- These systems don't "learn."
- These systems are deterministic (vs probabilistic) in outcome - *X in always equals exactly Y out*.



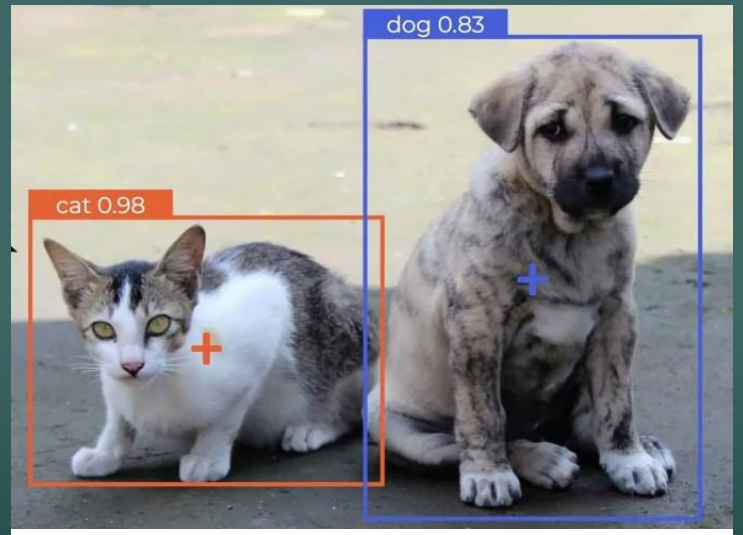
The Kasparov-Depp Blue series of chess matches in 1996 and 1997 were pivotal moments in both chess and computing history, symbolizing the rise of machine intelligence and its ability to challenge human strategic thinking.

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Basic Categories of AI: Machine Learning

Statistical systems that use neural nets, which are probabilistic in nature (but can approach deterministic in outcome).

- These systems are “trained” and “learn.”
- Once the model is trained and “frozen,” the exact input and the same weighting will produce the same statistical output (e.g. the same picture of a cat will produce the same percentage outcome).
- Rule based governing systems are used to mitigate inexact input (environmental noise) by categorizing output (e.g. anything above X% will be considered Y).



MLlib PyTorch H2O.ai
scikit learn XGBoost LightGBM
TensorFlow CatBoost sklearn

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Basic Categories of AI: Generative

Generative AI systems are ML systems that produce new content via iterative sampling (i.e. cumulative prediction) and which use controlled randomness (“temperature”) for creativity.

ML makes one prediction and it doesn’t “create” anything. It just renders a prediction (e.g. spam score = 0.7).

Generative AI makes predictions step-by-step and creates something new (A => %B, A & B => %C, A & B & C => D, etc.)



ChatGPT Gemini Copilot

Mistral Claude LLaMA

DALL·E DeepMind

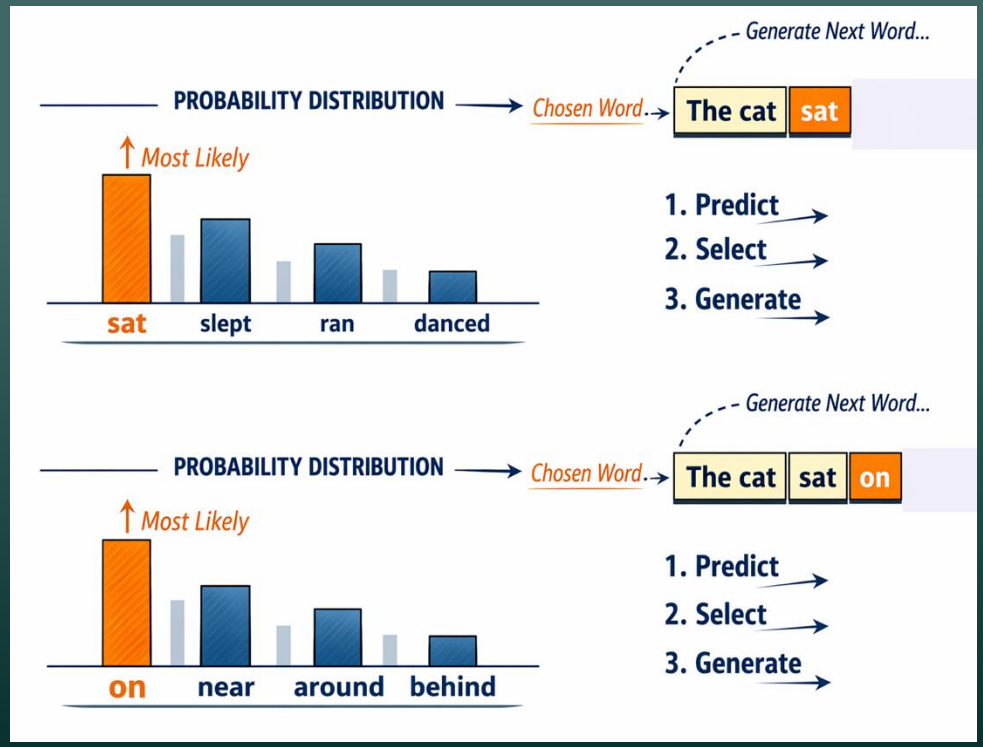
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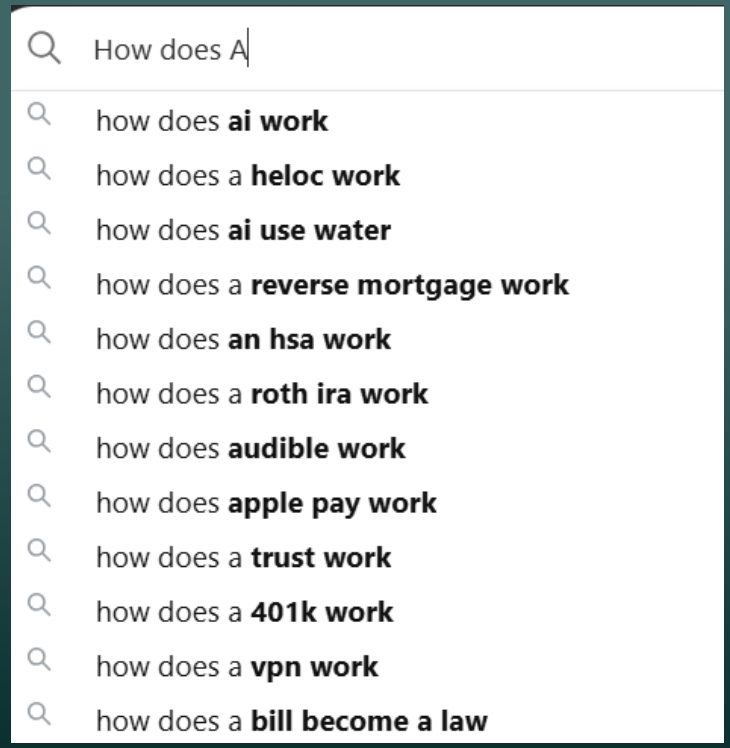
Basic Categories of AI: Generative

A favorite analogy: Generative AI is like text prediction on an enormous scale and with a broader range.

Examples of Iterative Sampling & Text Prediction

(A => %B, A & B => %C, A & B & C => D, etc.)





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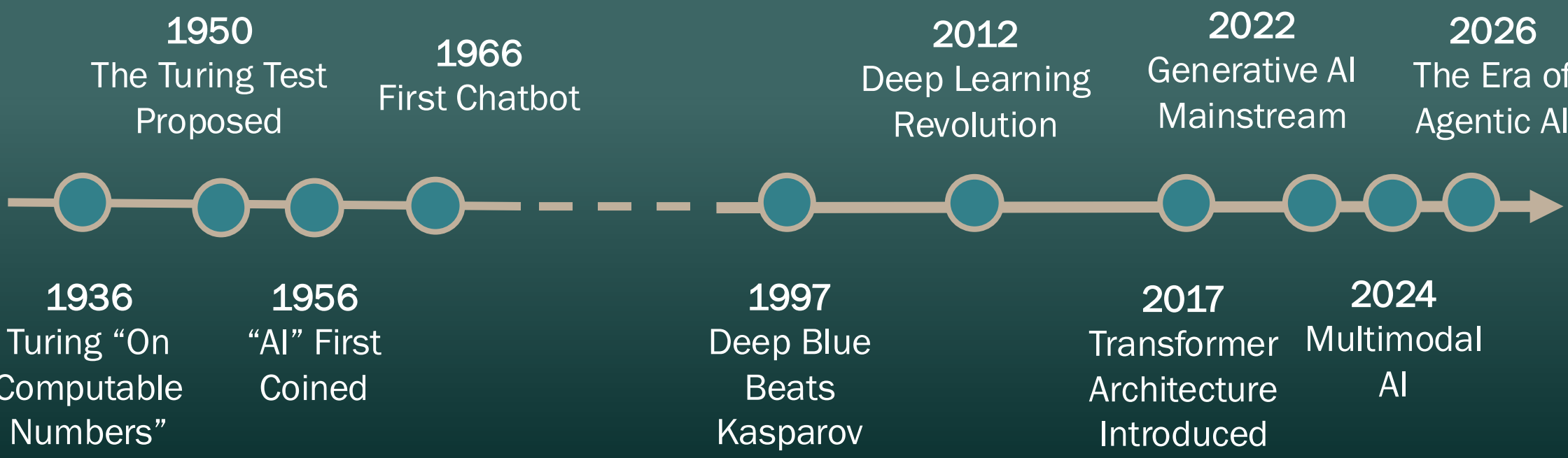
Basic Categories of AI: Agentic

Agentic AI is simply Generative AI that can use the applications on your computer as tools.

This is where a lot, but not all, of the really big problems have happened with AI.



AI is Not New: A Brief Evolution of Artificial Intelligence



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AI as the Next Tool in a Series

Math, music notation, chemistry notation, symbolic logic, billing notation, etc. are all symbolic systems that present (encode) ideas, structures, or relationships…Symbolic systems are a language…Written language itself is a symbolic system.

Generative AI process languages (any symbolic system) as a prediction of patterns.

We have reached a level where we process natural language and use it to analyze and translated between systems (music, math, programming, images, whatever).

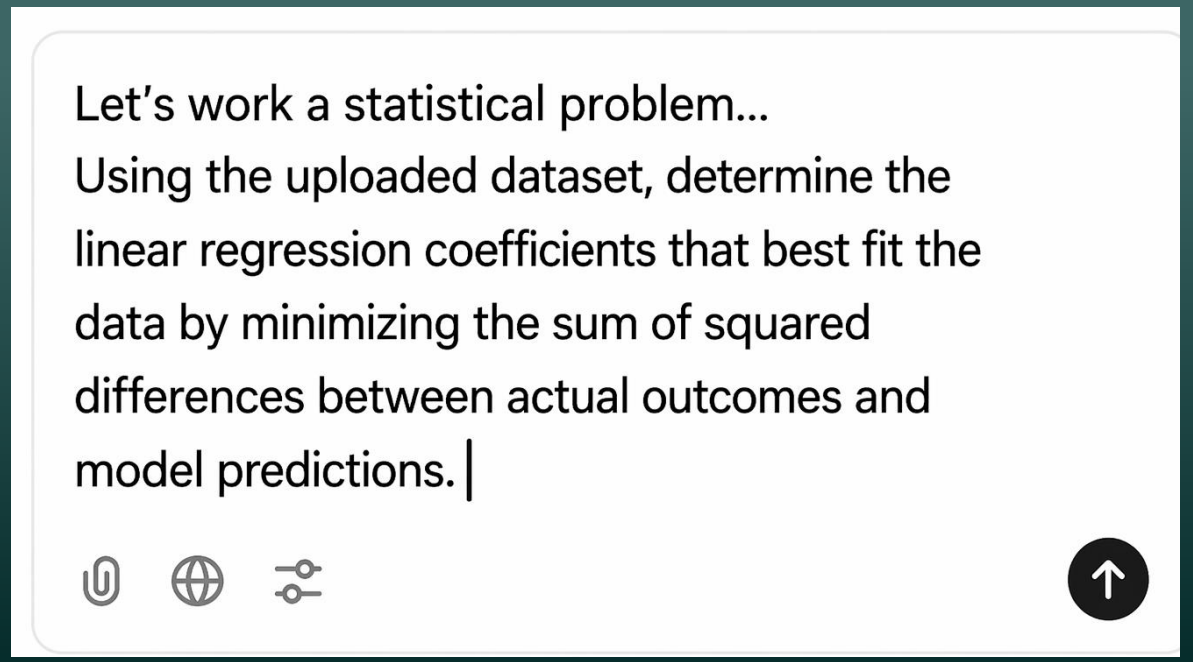
AI as the Next Tool in a Series

Instead of using formulas like this:

$$\min \beta \sum_{i=1}^{n} (y_i - x_i^T \beta)^2$$

y_i = Maint Cost per Mile
x_i = Vectors of [Traffic, Age, Precip, FreezeThaw, Truck%]
β = coefficients the model is solving for
n = number of road segments

We can now simply use natural language:



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The Question of Trust

THE QUESTION:
AI hallucinates, so how do we trust it?

(This statement applies mostly to generative AI and not so much to ML)

ChatGPT can make mistakes. Check important info.

Gemini is AI and can make mistakes.

BUSINESS

Google's 'AI Overviews' advises adding glue to pizza sauce, lists 'health benefits' of tobacco for tweens

By Thomas Barrabi

Published May 23, 2024, 12:47 p.m. ET

41 Comments

AWESOME AGENTS / NEWS

Amazon's Kiro AI Deleted a Production Environment and Caused a 13-Hour AWS Outage

NOTE: One thing I notice in the article (and other such articles) is that the prompt is not presented.

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The Question of Trust

THE ANSWER:
You don’t trust Generative AI,
especially an AI agent, any more than you would a human.

(In many cases you don’t need to trust is any LESS than you would a human, either.)

Treat AI with at least the same security and validation considerations you would any employee.

Trust, but verify. Or well, maybe don’t trust so much and always verify.

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The Question of Trust: Guardrails

- Make a distinction between generative AI and ML (AI).
- Unlike more traditional programs, generative AI can confidently drive the bus off the cliff.
- Supply generative AI with guardrails like rule-based system “managers.”
- Treat it more like a human…check its work…plan for unforeseen corner cases.
- Apply it only as a suggestive tool (esp. generative AI and AI agents).
- Apply tiered or structured authentication with AI agents.

The Question of Trust: Guardrails

- AI agents get login credentials just like a human.
- What tools they are using, what purpose they are using them for, and for whom they are acting all get tracked.
- Hierarchical authentication – limiting ability to delete and update (for example).
- Deterministic oversite – traditional systems that look for unusual input or output.
- Human-in-the-Loop

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CRAB's Role

As a technical consultant, governing agency, and technical provider, CRAB is devoted to providing:

- Policy and governance guidance
- AI implementation and usage best practices
- Training for AI usage
- Assistance with vetting contractors

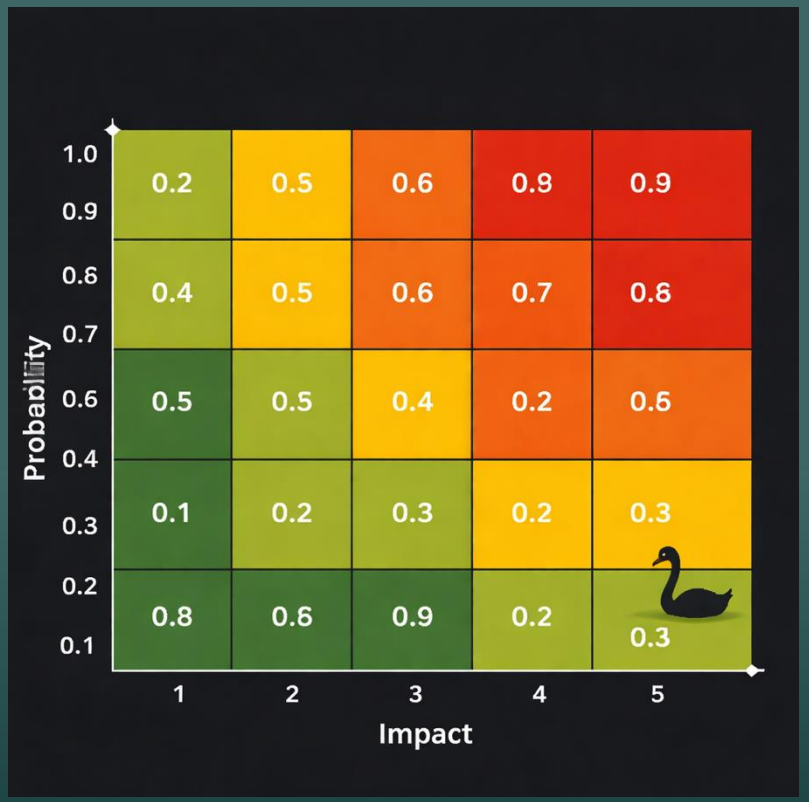
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So, What Can Your County Do with AI?

Almost anything you can train a person to do, you can train AI to do – if you have the time, knowledge, and money.

Human thinking and AI "thinking" are both based in pattern recognition and prediction, so anything involving recognizing patterns and predicting outcomes can be done by AI.

Humans can generate new material through combination, and AI can generate new material through combination.



AI is often not as good at big picture and core redesign...so *almost* anything. On the other hand, humans are not good at tirelessly parsing millions or even billions of records.

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So, What Can Your County Do with AI? **Collision Risk Analysis** (ML)

The Problem: County roads don't have "hot spots" like city roads. Identifying the most cost effective and impactive safety improvements (see FHA – SSPST) are a venture in prediction based on road qualities.

What AI Can Do: By analyzing factors such as road condition, asset condition, ADT, area context, etc. problem areas can be identified.

Examples:

- Benton County's collision analysis project (current)
- Ohio DOT machine learning systemic safety analysis (2022)

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So, What Can Your County Do with AI? **Distress Detection** (ML)

The Problem: Rating surface condition is a time-consuming process done at low speeds that creates a traffic obstruction.

What AI Can Do: With the use of LiDAR or external cameras, road imagery can be collected at speed and then AI can used to analyze the images for the various types of distresses and their severity rating.

Example: ARA is already well practiced at this process

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So, What Can Your County Do with AI? **Asset Condition Rating** (ML)

The Problem: Similar to surface condition rating, assessing the condition of signs, guardrails, and other road assets is time consuming and can create traffic obstructions.

What AI Can Do: Again, using external cameras (even Go Pro cameras) images of the road assets can be collected at speed and then AI can be used to rate their condition.

Example: ESRI is packaging up an AI service that will analyze your collected road assets pictures.

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So, What Can Your County Do with AI? **Deterioration Forecasting** (ML)

The Problem: Surface condition rating tells us what condition the road is in. Being able to predict how quickly a road will degrade is useful for cost predictions.

What AI Can Do: Through the analysis of factors such as material, weather, ADT, maintenance history, past surface condition ratings, etc.. AI can identify or predict areas that are or will likely be subject to more aggressive deterioration.

Examples:

- Louisiana DOTD pavement deterioration prediction project (2024)
- Colorado DOT ML deterioration forecasting research (2025 – 2027)

So, What Can Your County Do with AI? **Real Time Safety Monitoring** (ML)

The Problem: With limited resources, dangerous road conditions such as flooding, debris, adverse weather might go undetected until reported by motorists or emergency responders.

What AI Can Do: By analyzing live feeds from road cameras and other sensors, AI can rapidly detect potential safety hazards, alert transportation personnel and help prioritize emergency responses.

Examples:

- North Carolina Turnpike Authority piloting AI analysis of existing traffic cams to detect collisions, traffic violations, etc (2026).
- Nevada DOT's AI based roadway & work-zone detection system

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So, What Can Your County Do with AI? **ADT Monitoring** (ML)

The Problem: ADT monitoring is expensive and ever changing. With limited staff, collecting information is difficult.

What AI Can Do: AI can analyze video from existing or temporary cameras to automatically count and classify vehicles, calculate traffic volumes, identify turning movements and monitor changes in traffic patterns.

Examples:

Snohomish County is using AI video analytics to collect ADT information (as well as near-miss data, 2026)

MoDOT AADT Project piloted AI/ML video analytics to collect AADT data (2022 – 2024)

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So, What Can Your County Do with AI? **Anomaly and Data Quality Analysis** (ML/GEN)

The Problem: The accumulation and processing of large amounts of data inevitably introduces errors and inconsistences that can be difficult and time consuming to detect.

What AI Can Do: Because AI doesn't suffer mistakes due to fatigue, it can process millions of records for anomalies and errors. This can save counties thousands of dollars in work hours.

Examples:

- U.S. Treasury using machine learning to identify suspicious Treasury checks (2024)
- FHWA developed an ML system to detect anomalies in the National Bridge Inventory (2022)

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So, What Can Your County Do with AI? **Part Failure Prediction** (ML)

The Problem: Maintenance schedules rely on operating hours and manufacturer recommendations. Parts can fail before scheduled maintenance or be replaced unnecessarily while still in good condition.

What AI Can Do: By analyzing part age, manufacture, run time, spikes, etc. AI can predict equipment failure to extend the life of parts while preventing failure.

Examples:

Neptunus & Indian Defense have an AI-powered preemptive condition monitoring tool

Pinellas Suncoast Transit Authority (Florida) use of AI-powered PMT

BNSF AI-powered predictive maintenance

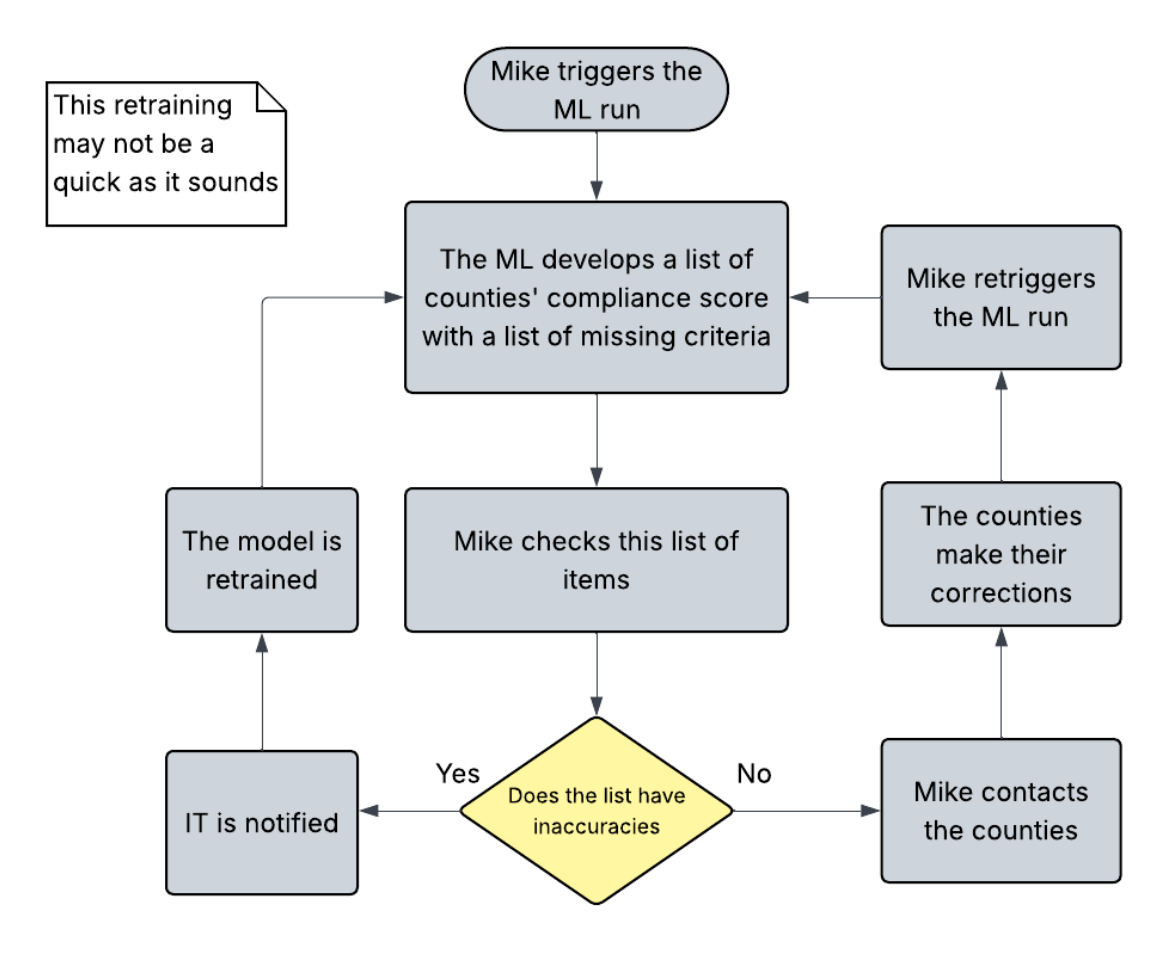
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So, What Can Your County Do with AI? **A Few More Ideas**

- Helpdesk ticket analysis / customer service response (ML & Gen AI)
- Policy analysis summary and reporting (ML & Gen AI)
- Potential non-compliance early detection (ML)
- Grant application scoring and compliance evaluation (ML or Gen AI)
- Evaluating, analyzing, and summarizing help and training requests (ML & Generative AI)

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An Example of AI (Suggestive) Assistance



NOTE: The ML is only suggesting what Mike should look at. The final decision to accept or reject the compliance score is Mike's.

This is a simple example that is similar to what we do with the Audit Trail report.

This is more scalable. It's more flexible. The output can be made more accessible. And…

All counties can easily be compared in one place and are ordered by severity.

Mike can address the AI in natural language to query different or more specific elements.

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Thank you!
Additional Discussion Time



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