

AI Uncovered: Details Matter

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Who am I?

What I do?

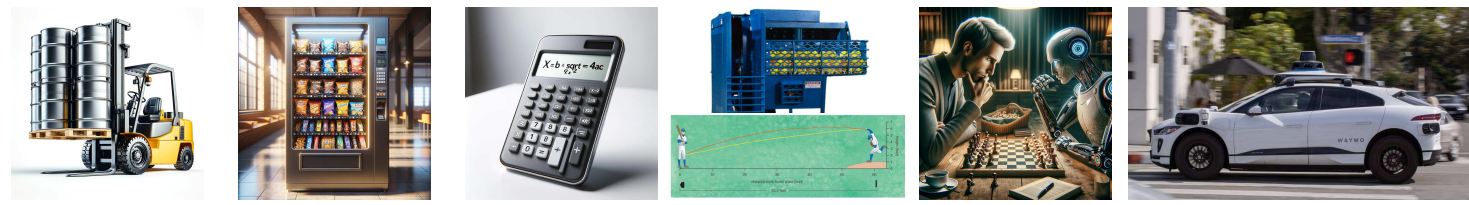
Why RPI?



Create a picture with researchers studying disease spread using data and machine learning with fancy visualizations and satellite data.

What is AI?

- Perform



- Create

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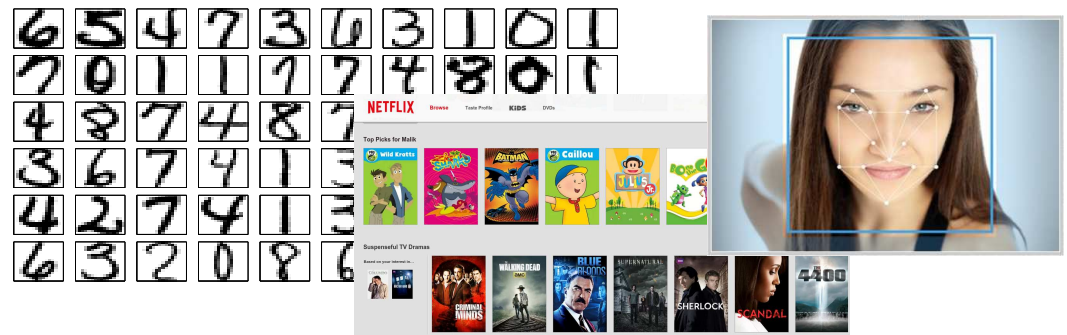


You
 create an image with mario and luigi from super mario brothers

ChatGPT
 I'm unable to create images of copyrighted characters like Mario and Luigi from Super Mario Brothers. However, if you have another request or a different idea for an image, I'd be happy to help with that. Let me know if there's anything else you'd like!



- Predict

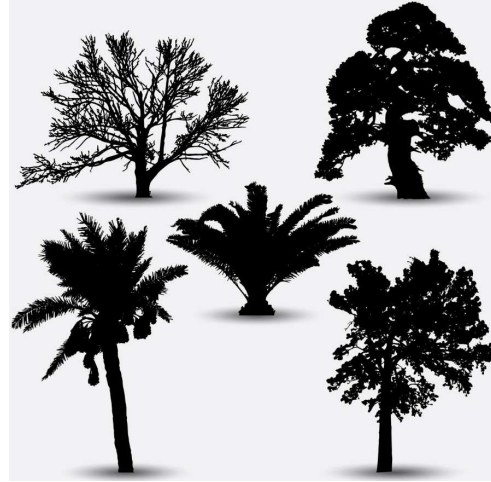


Machine Learning

Apqq's



Bqpp's



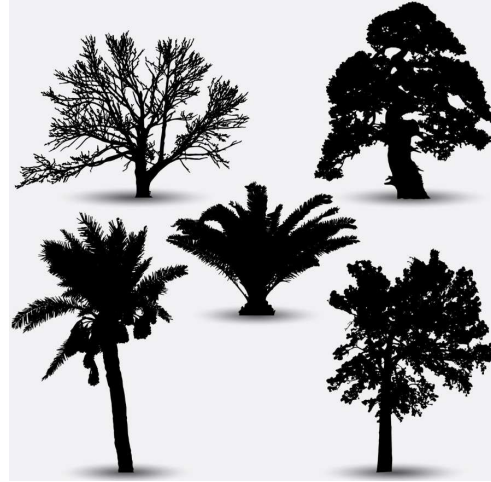
Data,
Training

Machine Learning

Apqq's



Bqpp's



Data,
Training



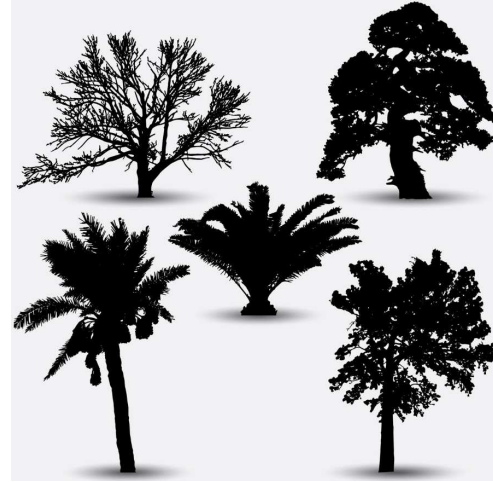
Test

Machine Learning

Apqq's



Bqpp's



Data,
Training



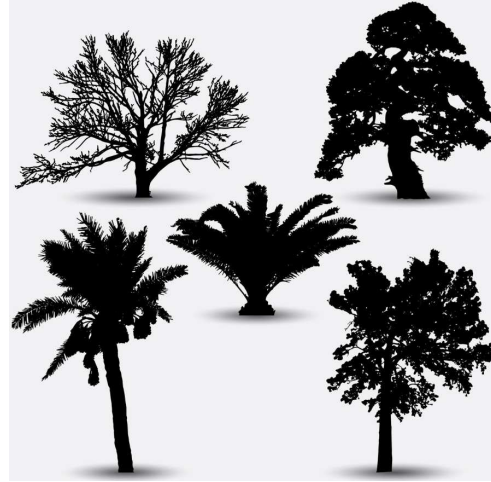
Test

Machine Learning

Apqq's



Bqpp's



Data, Training



You're using the invented words "**apqqs**" and "**bqpps**", and from context:

- The **first image** (with dogs) is labeled "**apqqs**" → likely means **dogs**
- The **second image** (with trees) is labeled "**bqpps**" → likely means **trees**

Third image:

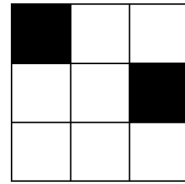
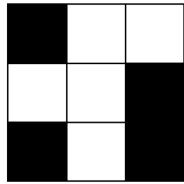
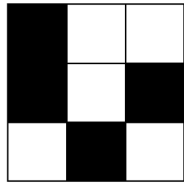
- Shows a **fluffy Chow Chow dog** standing on grass.
- It has fur, a tail, four legs, and a dog-like face.
- It does **not** resemble any part of a tree (no trunk, branches, or leaves).

✓ **Conclusion:**

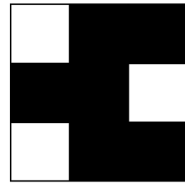
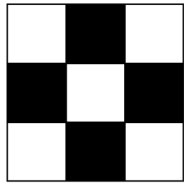
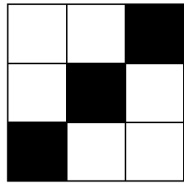
The third image is an **apqq** (i.e., **dog**), **not** a bqpp (tree).

Reason: It has all the anatomical features of a dog and none of a tree.

Machine Learning

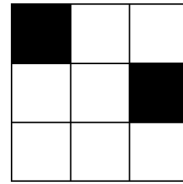
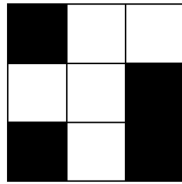
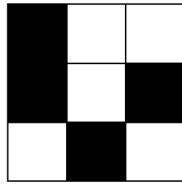


Dogs

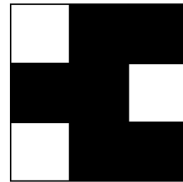
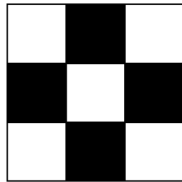
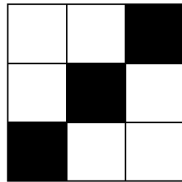


Trees

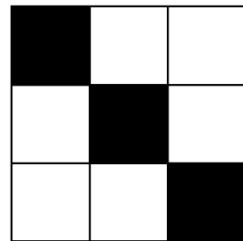
Machine Learning



Dogs

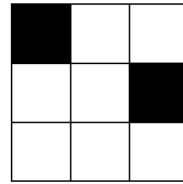
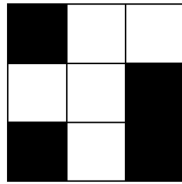
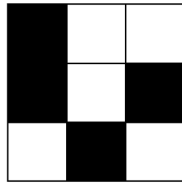


Trees

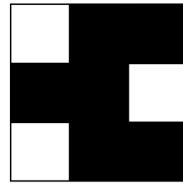
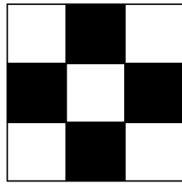
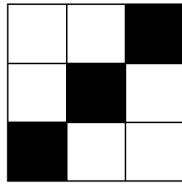


Dog or Tree?

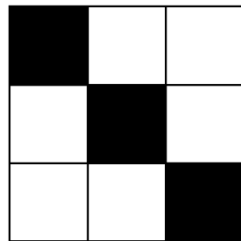
Machine Learning



Dogs



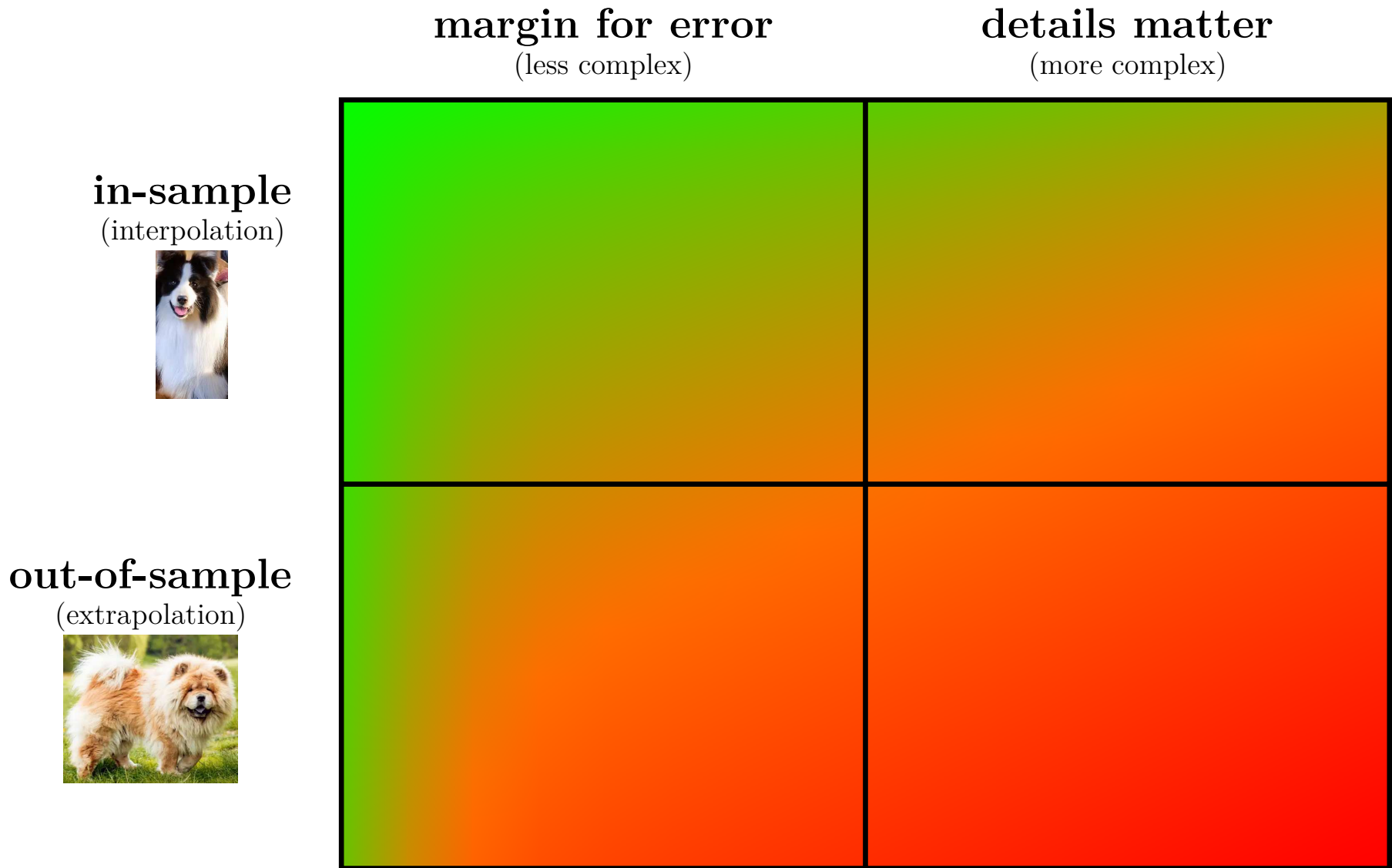
Trees



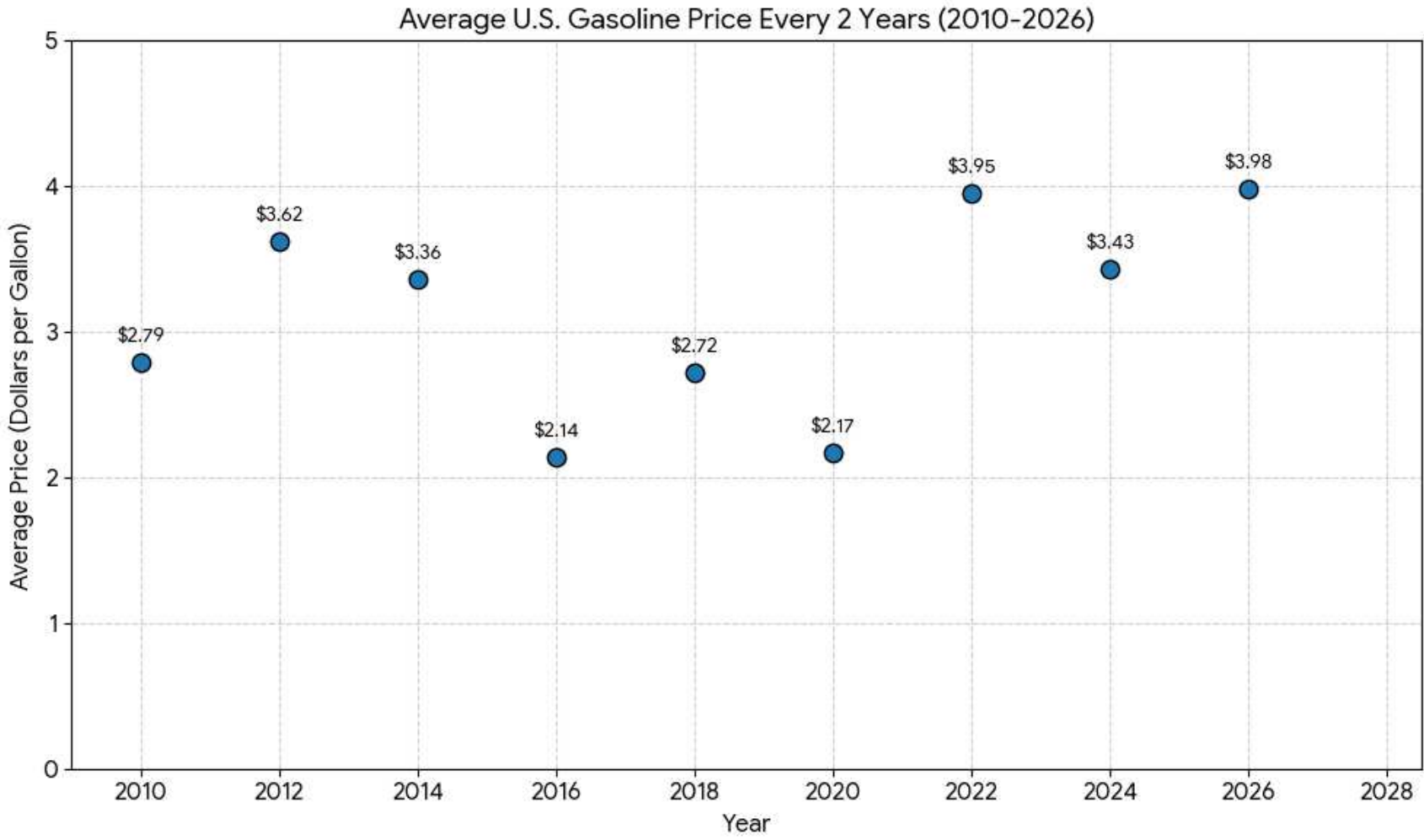
Answer: Tree

Explanation: The image lacks the regular, alternating pattern seen in the dog images and instead shows a clustering of black tiles characteristic of the tree images.

AI Trust It Tool: A Framework for Using AI



Gas Prices: In-Sample Vs. Out-of-Sample

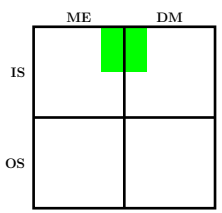
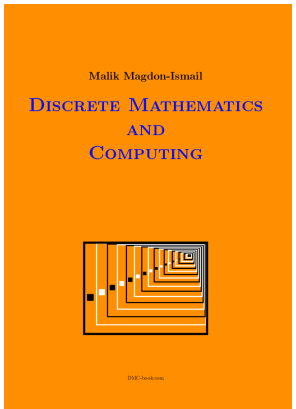


	ME	DM
IS		
OS		

	ME	DM
IS		
OS		

Competence: ChatGPT LRM 4o Aces FOCS Tests

	FOCS		
	Quiz 1	Quiz 2	Midterm
ChatGPT	100%	100%	94%
Students	77%	80%	75%



Are Engineers Out of Business?

I need to build a 1 mile suspension bridge across a river that flows at an average speed of 1 mile per hour and has an average depth of about 20 feet. The bridge will carry about 1000 cars per hour. How thick should my steel suspension cables be?

Step 1: Estimate Total Load

Let's assume:

- **Average car weight** = 4000 lb (2 tons)
- **Cars per hour** = 1000 → spread uniformly across the bridge
- **Bridge deck dead load** (self-weight + barriers, etc.) = **4,000 lb/ft**
- **Live load** (from cars) = **100 lb/ft²** (standard AASHTO HL-93 spec for lane)

Deck Area:

- Length = 5280 ft
- Width = ~40 ft
- Area = 211,200 ft²
- Live load = 100 lb/ft² → **21,120,000 lb**

Dead Load:

- Deck dead load = 4000 lb/ft × 5280 ft = **21,120,000 lb**

Total vertical load **W**:

Dead + Live = 21.1M + 21.1M = 42,240,000 lb

Step 2: Estimate Maximum Cable Tension

We model the cable as a **parabola** under uniform load.

Let:

- $L = 5280$ ft (main span)
- $f = \text{sag} = L/10 = 528$ ft (typical sag ratio 1:10)

The **horizontal tension** in a parabolic cable under uniform load is:

$$H = \frac{wL^2}{8f}$$

Where:

- $w = \text{uniform load per horizontal foot} = \frac{W}{L} = \frac{42,240,000}{5280} = 8000$ lb/ft

$$H = \frac{8000 \times (5280)^2}{8 \times 528} \approx 52,800,000 \text{ lb}$$

The **maximum total tension** occurs at the tower and is:

$$T = \sqrt{H^2 + (wL/2)^2}$$

$$T = \sqrt{(52.8 \times 10^6)^2 + (21.1 \times 10^6)^2} \approx 57.0 \times 10^6 \text{ lb}$$

Step 3: Compute Required Cross-Sectional Area

Let's use:

- Allowable stress for high-strength galvanized steel wire = **60,000 psi** (conservative)

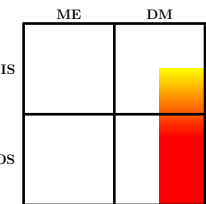
$$A = \frac{T}{\sigma} = \frac{57 \times 10^6}{60,000} \approx 950 \text{ in}^2$$

(Assuming **two main cables**, each carries half the load)

$$\text{Each cable area} = \frac{950}{2} = 475 \text{ in}^2$$

Step 4: Convert Area to Diameter

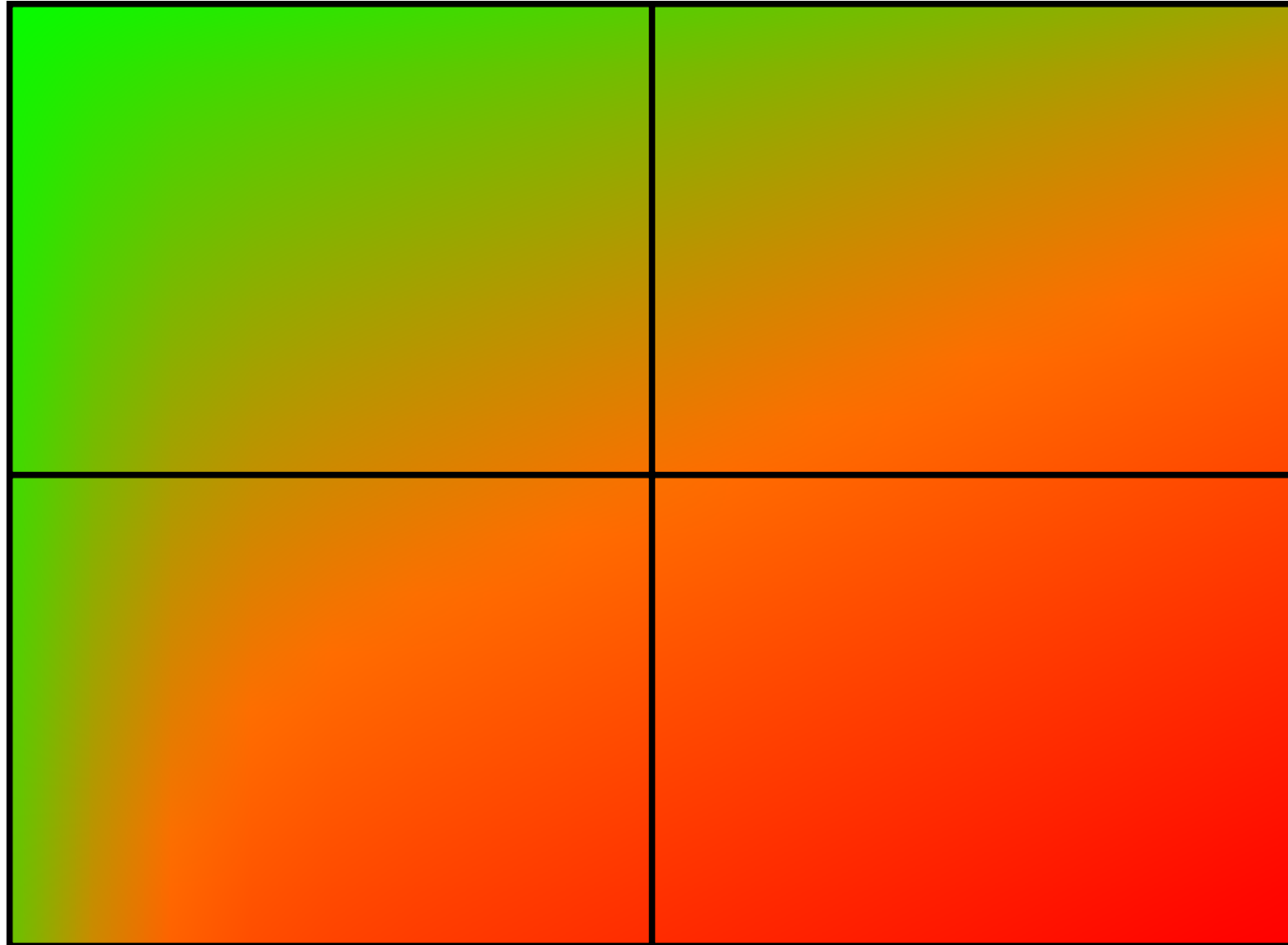
$$A = \frac{\pi d^2}{4} \Rightarrow d = \sqrt{\frac{4A}{\pi}} = \sqrt{\frac{4 \times 475}{\pi}} \approx 24.6 \text{ in}$$



margin for error

details matter

in-sample



out-of-sample

To err is human, but to really foul things up requires a computer
– Paul Ehrlich (?)/Bill Vaughan (1969)



Are Coders Out of Business?

Scaffolding

In New York City, Malik took the floor,
Discussing AI, a subject he adores.
With wit and insight quite nifty,
He enlightened the crowd on AI so **swiftly**.

```
latex
\documentclass{article}
\usepackage{tikz}
\usetikzlibrary{decorations.pathreplacing}

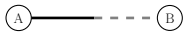
\begin{document}

\begin{tikzpicture}
% Nodes
\node[circle,draw,fill=white] (A) at (0,0) {A};
\node[circle,draw,fill=white] (B) at (4,0) {B};

% Solid black part (first half)
\draw[black, line width=1pt] (A) -- ($ (A)!0.5!(B) $);

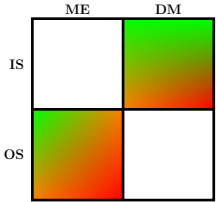
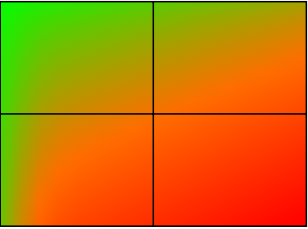
% Dashed gray part (second half)
\draw[gray, dashed, line width=1pt] ($ (A)!0.5!(B) $) -- (B);
\end{tikzpicture}

\end{document}
```



```
python

def is_prime(n):
    if n <= 1:
        return False
    if n <= 3:
        return True
    if n % 2 == 0 or n % 3 == 0:
        return False
    i = 5
    while i * i <= n:
        if n % i == 0 or n % (i + 2) == 0:
            return False
        i += 6
    return True
```



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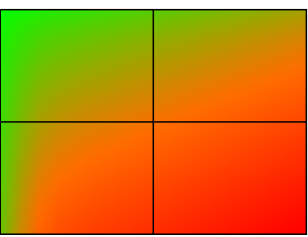
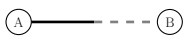
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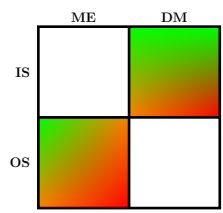
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\end{document}
    
```



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            return False
        i += 6
    return True
    
```



Debugging is undecidable

```

What does this python function do?
def Py1(n):
    if n <= 1:
        return False
    if n <= 3:
        return True
    if n % 2 == 0 or n % 3 == 0 or n % 5 == 0:
        return False
    i = 7
    while i * i <= n:
        for j in [0,4,6,10,12,16,22,24]:
            if n % (i+j) == 0:
                return False
            i += 30
    return True
    
```

The function `Py1(n)` tests whether a number `n` is prime, using an efficient wheel factorization approach based on skipping obvious composite numbers.

```

What does this python function do?
def Py1(n):
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    if n <= 3:
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    if n % 2 == 0 or n % 3 == 0 or n % 5 == 0:
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    i = 7
    while i * i <= n:
        for j in [0,4,6,10,12,16,22]:
            if n % (i+j) == 0:
                return False
            i += 30
    return True
    
```

The Python function `Py1(n)` determines whether the integer `n` is a prime number using an optimized trial division method called wheel factorization (specifically a 30-wheel).

AI coding tools make developers slower but they think they're faster, study finds

Predicted a 24% boost, but clocked a 19% drag

- "Over-optimism about AI usefulness" (developers had unrealistic expectations)
- "High developer familiarity with repositories" (the devs were experienced enough that AI help had nothing to offer them)
- "Large and complex repositories" (AI performs worse in large repos with 1M+ lines of code)
- "Low AI reliability" (devs accepted less than 44 percent of generated suggestions and then spent time cleaning up and reviewing)
- "Implicit repository context" (AI didn't understand the context in which it operated).

https://www.theregister.com/2025/07/11/ai_code_tools_slow_down/

