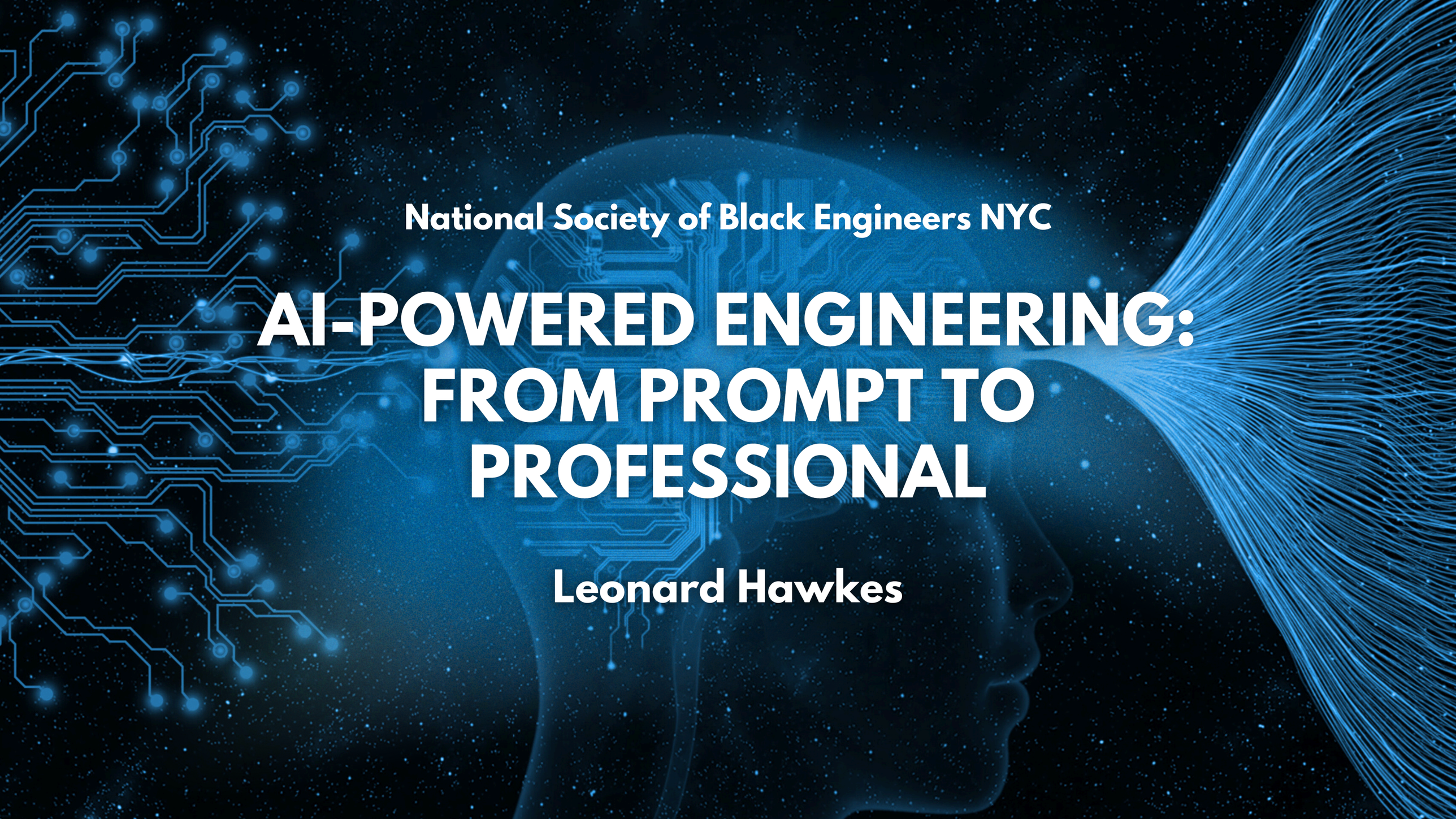
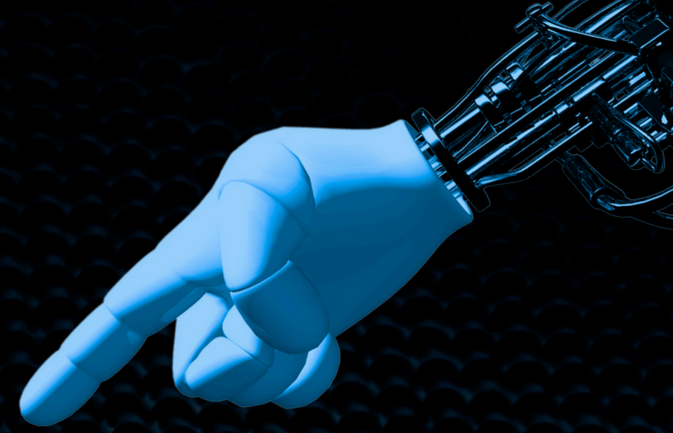

National Society of Black Engineers NYC
AI-POWERED ENGINEERING: FROM PROMPT TO PROFESSIONAL
Leonard Hawkes

Workshop Overview

Objective: Transform engineering professionals from AI consumers to AI creators while understanding both opportunities and risks

Key Learning Outcomes:

1. Understand the current AI landscape and its implications for engineering
2. Master practical AI tools for academic and professional success
3. Learn ethical AI usage and risk mitigation strategies
4. Develop a personal AI integration roadmap
5. Build confidence in leading AI adoption in engineering contexts
6. Apply AI skills to enhance daily life and personal productivity



The Current Moment

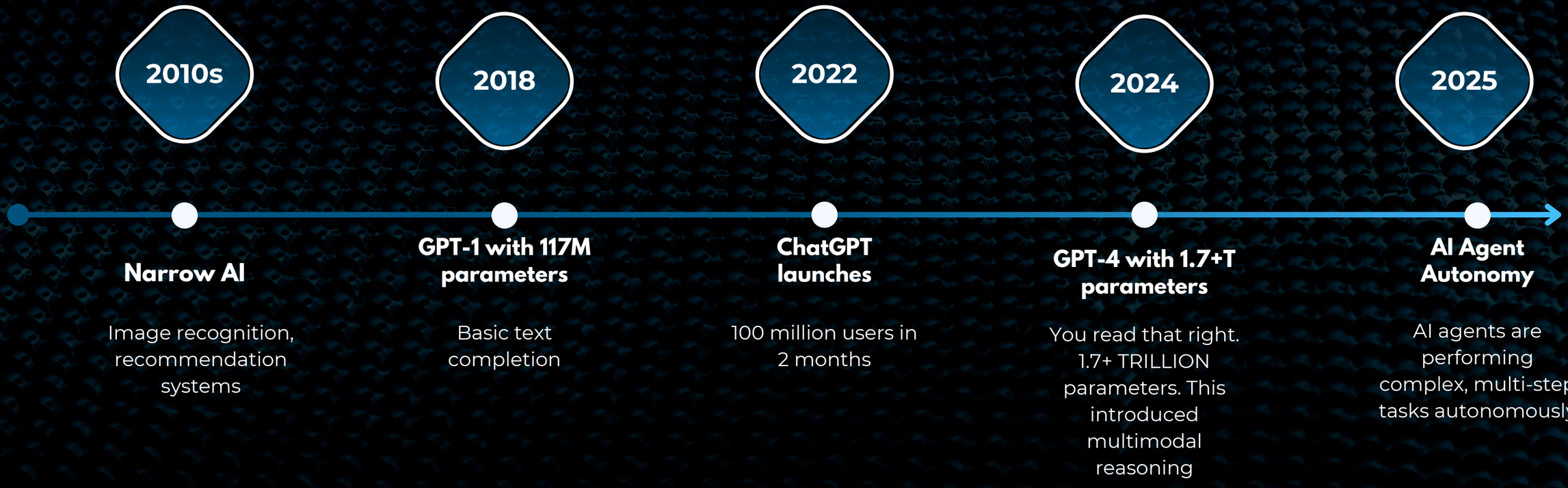
We are living through the most significant technological transformation since the internet. For engineers, this moment is particularly critical because:

- **AI is moving from research labs to production systems**
- **Engineering firms are rapidly adopting AI tools across all disciplines**
- **Early adopters are gaining significant competitive advantages**
- **The skills gap between AI-literate and traditional engineers is widening rapidly**

As Black engineers, we have a unique opportunity to lead this transformation rather than follow it. Historically, technological shifts have sometimes widened professional gaps. This time, we can be the leaders, the innovators, and the ethical voices guiding AI development.

The GenAI Revolution

From Narrow AI to Generative AI



Traditional AI vs Generative AI

Traditional AI Characteristics:

- **Rule-based systems:** If-then logic structures
- **Narrow functionality:** Designed for specific tasks
- **Predictable outputs:** Same input → same output
- **Limited creativity:** Cannot generate novel solutions
- **Examples:** Spam filters, recommendation engines, fraud detection

Generative AI Characteristics:

- **Pattern-learning systems:** Learn from vast datasets
- **Broad adaptability:** Can handle diverse, unstructured problems
- **Variable outputs:** Same input can produce different valuable results
- **Creative capabilities:** Can generate novel ideas, code, designs
- **Examples:** ChatGPT, Claude, GitHub Copilot, Grok, DALL-E

For Engineers, This Means:

- **Traditional approach:** Build specific tools for specific problems
- **Generative approach:** Use flexible AI assistants for diverse challenges
- **Impact:** From automation of routine tasks to augmentation of creative problem-solving

Risk Consideration:

- Generative AI can produce confident-sounding but incorrect results
- Outputs may reflect biases present in training data
- Over-reliance can diminish critical thinking skills
- Intellectual property and originality concerns

The NSBE Advantage:
Why Engineers Will Lead AI Adoption

1

Systematic Thinking

Engineers naturally break complex problems into manageable components. This directly translates to effective prompt engineering and AI system design.

Ex: When designing a bridge, factors like loads, materials, environmental elements, and safety margins are essential. Similarly, designing prompts involves considering context, constraints, expected outputs, and error handling.

2

Understanding Constraints and Trade-offs

Engineers are trained to optimize within constraints(cost, materials, time, safety). AI systems also require understanding trade-offs between accuracy, speed, cost, and interpretability.

Ex: choosing between a complex AI model(high accuracy, high cost) vs simple model(good accuracy, low cost) mirrors engineering decisions about material selection.

3

Domain Expertise in Critical Fields

AI needs human experts to validate outputs, understand context, and ensure safety. Engineers provide this expertise in infrastructure, manufacturing, energy, and technology sectors.

4

Iterative Problem-Solving Approach

Engineering design is inherently iterative: design → test → refine → repeat. This maps perfectly to AI development: prompt → test → refine → repeat.

5

Safety and Risk Management Culture

Engineers are trained to think about failure modes, safety factors, and risk mitigation.

The Responsibility: With these advantages comes the responsibility to lead ethical AI adoption and ensure these powerful tools serve all communities equitably.

6

Evidence-Based Decision Making

Engineers prioritize data, testing, and measurable results over intuition. This analytical approach is essential for effective AI adoption, ensuring outputs are validated and performance is measured for data-driven improvements.

AI for Career Development

Resume & Applications

- ATS optimization & content enhancement
- Tailored applications at scale

Interview Prep

- AI mock interviews & industry research
- Networking content generation

Skill Development

- Personalized learning paths
- Progress tracking & gap analysis

Professional Portfolio

- Project documentation & case studies
- Content creation & thought leadership

AI Across Engineering Disciplines

Civil Engineering

- **Building design optimization & traffic analysis**
- ***Example: Autodesk AI reduces design time 50%***

Mechanical Engineering

- **Thermal analysis & predictive maintenance**
- ***Example: GE improves fuel efficiency 15%***

Electrical Engineering

- **Circuit design & power optimization**
- ***Example: Tesla's AI chips 10x faster***

Software Engineering

- **Code generation & testing automation**
- *Example: GitHub Copilot 55% faster coding*

⚠️ **Remember: Always validate AI outputs!**

Prompt Engineering: The CLEAR Framework

(Context| Length| Examples| Audience| Role)

C - Context

- Provide relevant background information
- *Example: "I am designing a water treatment facility for a municipality of 50,000 people. The facility must comply with EPA regulations and process 5 million gallons per day."*

L - Length

- Specify output format
- *Example: "Provide a 2-page technical summary with bullet points for key recommendations and a detailed 3-step implementation plan."*

E - Examples

- Provide samples of desired output format
- *Example: "Similar to the San Francisco water treatment upgrade project, but adapted for our smaller scale and different regulatory environment."*

A - Audience

- Define who will use or review the output
- *Example: "This will be presented to city council members with limited technical background, so use clear explanations and focus on costs, timeline, and community benefits."*

R - Role

- Assign the AI a specific professional role or perspective
- *Example: "Act as a senior civil engineer with 15 years of water treatment experience and expertise in EPA regulations."*

Essential AI Tools

General Purpose

- **ChatGPT:** Quick questions & code generation
- **Claude:** Complex analysis & research
- **Perplexity:** Real-time research with sources

Engineering Specific

- **GitHub Copilot:** AI coding assistant
- **Notion AI:** Project documentation
- **Autodesk/ANSYS/SolidWorks AI:** Design tools

🔐 **Security First: Protect proprietary data**

Building “NSBE Engineering Assistant”

What We’re Creating:

- Professional workflow optimizer
- Engineering calculation tools
- Career advancement resources

Live Building Process:

1. Identify real workplace challenge
2. Apply CLEAR framework
3. Build working solution
4. Test with professional scenarios

Ethical Considerations:

- **Bias mitigation:** Ensure diverse perspectives in AI workflows
- **Privacy protection:** Secure handling of client and proprietary data
- **Professional Integrity:** Maintain accountability for AI-assisted work
- **Accessibility:** Design tools for users with different abilities

AI Ethics for Engineers

Core Responsibilities

- **Public Safety:** Maintain human oversight
- **Professional Integrity:** Validate all AI outputs
- **Bias Mitigation:** Include diverse perspectives
- **Data Privacy:** Protect sensitive information

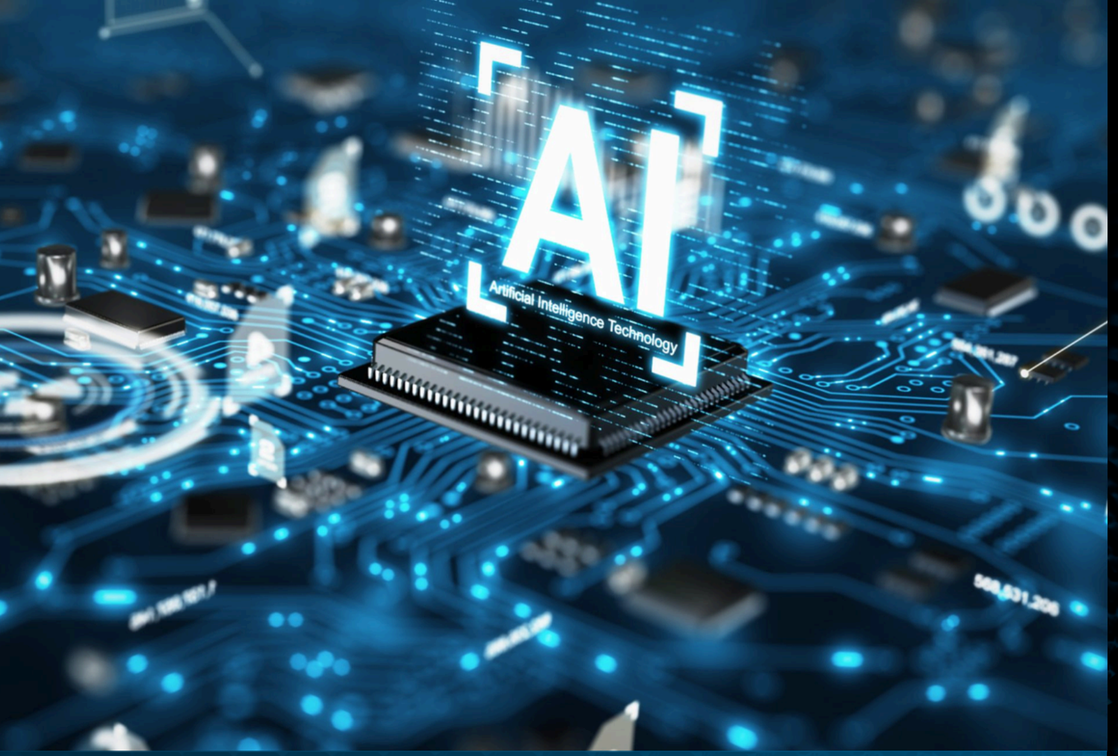
Real-World Studies

Case Study 1: Algorithm Bias in Infrastructure Planning

- **Situation:** AI traffic optimization favored affluent neighborhoods.
- **Engineering Failure:** Lack of equity consideration in algorithm design.
- **Lessons Learned:** Involve diverse stakeholders in AI design and testing.
- **Prevention:** Conduct regular bias audits and community impact assessments.

Case Study 2: Over-reliance on AI in Structural Design

- **Situation:** Engineering firm relied on AI for structural calculations without sufficient human review.
- **Result:** Miscalculations of critical safety factors in commercial building design.
- **Engineering Failure:** Neglect of professional responsibility for design validation.
- **Lessons Learned:** AI should augment, not replace, engineering judgment.



What's Coming Next

Agentic AI

- Autonomous problem-solving systems
- Self-managing infrastructure
- Predictive maintenance scheduling and execution
- Real-time quality control and process adjustment

Multimodal AI

- Vision + audio + text integration
- Integrated CAD design with visual and performance feedback
- New possibilities for remote collaboration and control

AI + IoT

- Smart buildings & infrastructure
- Real-time optimization
- Environmental monitoring with predictive intervention

Quantum-AI

- Advanced materials discovery
- Complex system optimization (traffic, energy, logistics)
- Cryptography and security for engineering systems

AI Career Levels

Level 1: Use AI tools effectively (0-6 months)

Level 2: Create custom solutions (6-18 months)

Level 3: Build AI applications (18+ months)

Level 4: Lead AI transformation (2+ years)

AI Engineer

- Design and implement AI systems for engineering applications
- Salary range: $90k-$200k+ depending on experience and location
- Growth area: High demand across all engineering sectors

Prompt Engineer

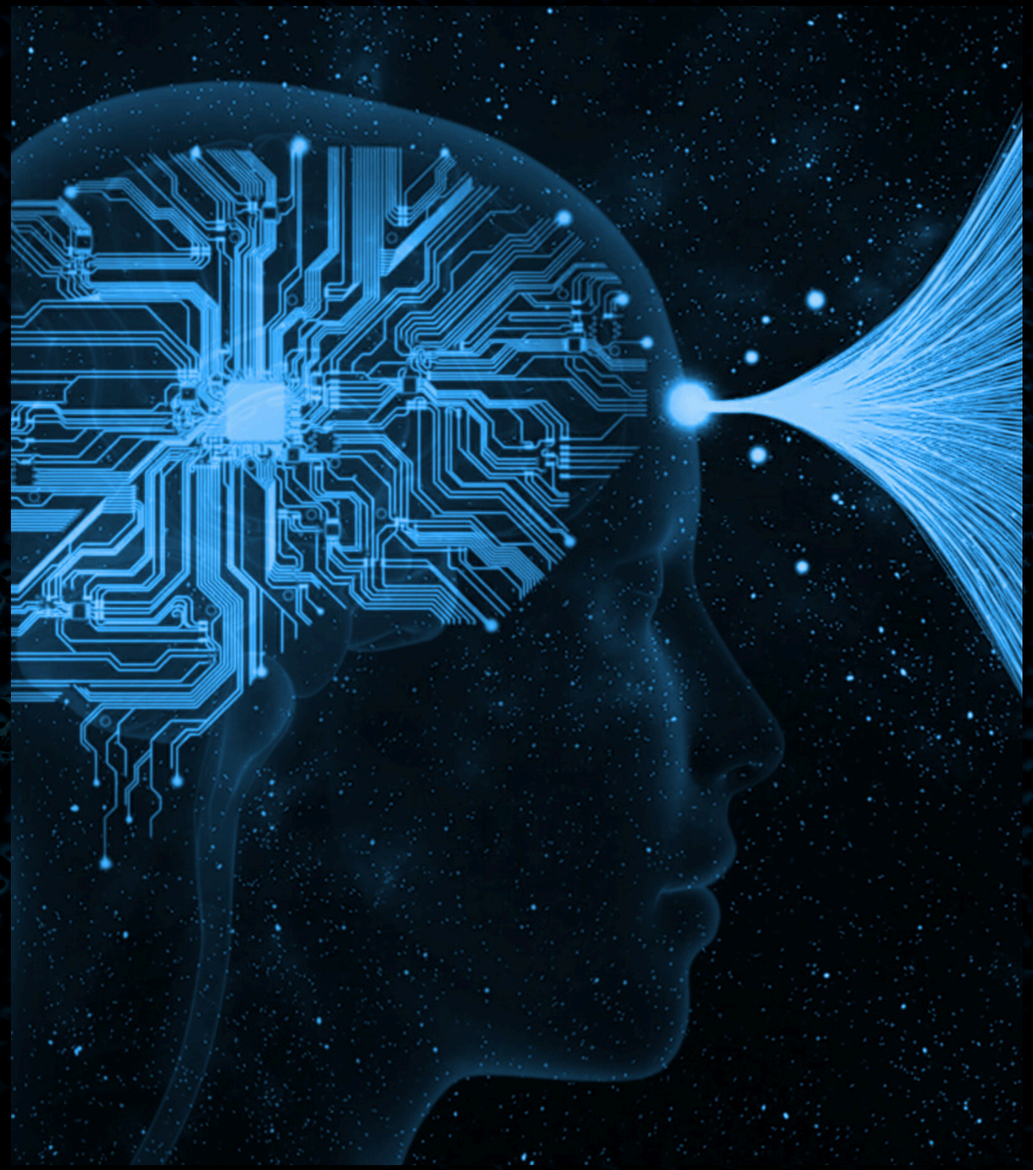
- Specialize in human-AI communication and workflow optimization
- Emerging role with rapid growth potential
- Critical for organizations adopting AI at scale

AI Ethics Specialist

- Ensure responsible AI development and deployment in engineering
- Increasingly important for regulated industries
- Combines technical knowledge with ethical and legal expertise

ML Engineer

- Apply ML techniques to engineering-specific problems
- Bridge between AI research and engineering applications
- High growth potential in autonomous systems and IoT



Your Next Steps

This Week:

- Set up ChatGPT & Claude accounts
- Try CLEAR framework on one task
- Connect with AI learning communities

Free Learning Resources:

- Coursera: “Machine Learning for Everyone” by Andrew Ng
- edX: “Introduction to AI” by MIT
- Kaggle Learn: Practical AI/ML micro courses
- YouTube: “3Blue1Brown” neural network series

Next 3 Months:

- Complete AI course in your field
- Experimenting with 3-5 tools
- Present findings to your team

This Year:

- Lead AI pilot project
- Develop recognized expertise
- Mentor others in AI adoption

Lead The Future

The Opportunity: Engineers will lead AI transformation

Your Mission:

- Start learning today
- Share knowledge generously
- Build bridges, not barriers
- Lead with values

The future of engineering is not human vs AI, it’s human + AI