**Class Notes: ITAI 2372 – AI and Blockchain Integration**

**Lecture delivered by: Professor Anna Devarakonda**

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**Topic:** **AI Use Cases For Blockchain Technology**

**Overview -** The combination of AI and blockchain unlocks powerful synergies: blockchain provides trust, security, and decentralization, while AI brings intelligence, adaptability, and efficiency.

1. **Smart Contracts Optimization**

AI can enhance smart contracts—self-executing agreements on blockchain—by optimizing their logic and efficiency. Machine learning algorithms can analyze contract patterns, predict outcomes, and suggest improvements to reduce fees like transaction costs on blockchain networks like Ethereum or streamline execution. For example, AI could identify redundant conditions in a contract and propose leaner code, ensuring faster processing while maintaining security**.**

1. **Altering smart contracts**

While traditional blockchain smart contracts are immutable once deployed, AI can assist in creating adaptable frameworks. AI-driven systems could simulate "upgradeable" smart contracts by predicting future needs and embedding flexible parameters. Proxy contracts or modular designs, guided by AI insights, allow updates without breaking decentralization principles, balancing immutability with adaptability

1. **Fraud detection and security**

AI excels at pattern recognition, making it ideal for spotting anomalies in blockchain transactions. By analyzing transaction histories, wallet behaviors, and network activity, AI can flag potential fraud—like money laundering or phishing attacks—in real time. Combined with blockchain’s tamper-proof ledger, this creates a robust security layer for DeFi platforms, exchanges, and NFT marketplaces.

1. **Data marketplace and monetization**

Blockchain enables decentralized data marketplaces where users own and trade their data securely. AI enhances this by valuing data based on quality, relevance, and demand, using predictive models. For instance, an AI algorithm could assess a dataset’s utility for training models and set a fair price, while blockchain ensures transparent, trustless transactions between buyers and sellers.

1. **Supply chain management**

Blockchain provides transparency in supply chains by recording every step on an immutable ledger. AI complements this by analyzing data—such as shipment delays, weather impacts, or demand spikes—to optimize logistics, predict bottlenecks, and automate decision-making. Together, they enable real-time tracking and smarter resource allocation, reducing costs and improving efficiency.

1. **Identity verification**

Blockchain allows users to control their data. AI can enhance this by verifying identities through biometric analysis or behavioral patterns while keeping data encrypted on-chain. This creates secure, privacy-focused authentication for applications like voting or financial services.

1. **Predictive analytics in Crypto trading**

AI-powered predictive models analyze market trends, sentiment, and historical blockchain data to forecast crypto price movements. Blockchain ensures the integrity of the data fed into these models, preventing manipulation. Traders and decentralized autonomous organizations (DAOs) can use these insights for more informed strategies.

1. **Energy efficiency**

Blockchain networks, especially proof-of-work systems like Bitcoin, are energy-intensive. AI can optimize energy use by predicting peak loads, adjusting mining operations, or improving consensus algorithms.

1. **Health records and data security**

Blockchain secures health records by storing them in a decentralized, encrypted format accessible only to authorized parties. AI enhances this by analyzing records for diagnostics, predicting outbreaks, or personalizing treatments while respecting privacy. Patients control access via blockchain keys, and AI ensures data insights don’t compromise security.

1. **Decentralized AI Governance**

AI models often lack transparency in decision-making. Blockchain can host decentralized AI systems where governance rules, training data, and model updates are recorded transparently.