Introduction to Management Information Systems

What is Artificial Intelligence?

What is Artificial Intelligence?

- Artificial Intelligence represents the development of computer systems capable of performing tasks that typically require human intelligence.
- Unlike traditional programming where every rule must be explicitly coded, AI systems can identify patterns, learn from experience, and make decisions with varying degrees of autonomy.
- The field emerged in the 1950s with early pioneers like Alan Turing, John McCarthy, and Marvin Minsky, who laid the theoretical foundations for modern AI development.

What is Artificial Intelligence?

- The learning capability of AI systems comes from their ability to process vast amounts of data and identify patterns that might be imperceptible to humans.
- For example, an AI system analyzing medical images can learn to detect subtle indicators of disease by processing thousands of labeled examples, eventually matching or even surpassing human diagnostic accuracy in specific domains.

What is Artificial Intelligence?

- Adaptation in AI systems occurs through continuous exposure to new data and feedback loops.
- When an e-commerce recommendation system suggests products, it learns from user interactions (purchases, clicks, or ignores) to refine its future recommendations.
- This adaptability makes AI systems increasingly valuable as they accumulate more data and experience.

Types of Artificial Intelligence?

Narrow/Weak AI

- Current AI systems fall into the category of narrow or weak AI, designed to excel at specific tasks within well-defined boundaries.
- These systems demonstrate remarkable capabilities within their domains but lack true understanding or general problem-solving abilities.
- For instance, IBM's Deep Blue could defeat world chess champions but couldn't play checkers or understand the cultural significance of chess.

Narrow/Weak AI

Modern examples include:

- Language models that can generate human-like text but don't truly understand meaning
- Image recognition systems that can identify objects with high accuracy but don't comprehend what they're seeing
- Recommendation engines that can predict user preferences but don't understand the concepts of taste or preference

General/Strong AI

General AI remains a theoretical concept representing systems with human-like general intelligence capabilities.

Such systems would be able to:

- Transfer knowledge between domains
- Understand context and nuance
- Demonstrate self-awareness and consciousness
- Solve novel problems without specific training

General/Strong AI

While this remains in the realm of science fiction, research continues in areas like transfer learning and multi-task AI systems that might eventually lead toward more general AI capabilities.

Foundations of Artificial Intelligence

Components of Artificial Intelligence Systems

Data: The Foundation

Data serves as the primary fuel for AI systems, with quality and quantity both playing crucial roles.

Modern AI systems require:

- Large-scale datasets for training (often millions of examples)
- Clean, well-labeled data for supervised learning tasks
- Diverse data to ensure robust performance
- Continuous data streams for ongoing learning and adaptation

Data: The Foundation

For example, an AI system for fraud detection needs historical transaction data, including both legitimate and fraudulent examples, user behavior patterns, and real-time transaction information to make accurate predictions.

Algorithms: The Brain

AI algorithms represent the mathematical and logical structures that process data and generate outputs. Key algorithmic approaches include:

- Neural networks modeled after biological brain structures
- Decision trees for logical reasoning and classification
- Genetic algorithms that mimic evolutionary processes
- Probabilistic models for handling uncertainty

Algorithms: The Brain

For instance, a neural network for image recognition might have multiple layers that progressively identify more complex features, from simple edges to complete objects.

Computing Power: The Engine

Modern AI systems require substantial computational resources:

- Graphics Processing Units (GPUs) for parallel processing
- Distributed computing systems for handling large-scale operations
- Memory and storage systems for managing vast datasets
- Network infrastructure for real-time processing

Computing Power: The Engine

Cloud computing platforms like AWS, Google Cloud, and Azure have democratized access to these resources, making AI development more accessible to organizations of all sizes.

continue?

Intelligent Information Systems

Functional Applications of Information Systems

intelligent information

- External databases
- Technology reports like patent records etc.
- Technical reports from consultants
- Market reports
- Confidential information about competitors
- Speculative information like market conditions
- Government policies
- Financial reports and information

business intelligent (BI)

Business Intelligence System

finds patterns from existing operational data

- evolved from the decision support systems
- technology and applications like
  - data warehouses,
  - Executive Information Systems (EIS) and
  - Online Analytical Processing (OLAP)

characteristics of intelligent systems

- extension of Executive Support / Information Systems
- combination of skills, processes, technologies, applications and practices
- contains background data / reporting tools
- a set of concepts and methods strengthened by fact-based support systems
- It collects, integrates, stores, analyzes, and provides access to business information
- business users get reliable, secure, consistent, comprehensible, easily manipulated and timely information.
- provides business insights that lead to better, faster, more relevant decisions

intelligent systems benefits

- improved management processes
- planning, controlling, measuring and/or applying changes that results in increased revenues
- reduced costs
- improved business operations
- intelligent future predictions
- fraud detection

intelligent systems approaches

improving reporting and analytical capabilities

- scorecards and dashboards
- Enterprise reporting
- OLAP (On-line Analytical Processing) Analysis
- Advanced and Predictive Analysis
- Alerts and Proactive Notification
- Automated generation of reports with user subscriptions and "alerts" to problems and/or opportunities.

intelligent systems capabilities

- Data Storage and Management –
  - Data warehouses
  - Ad hoc analysis
  - Data quality
  - Data mining

information delivery

- Dashboard
- Collaboration /search
- Managed reporting
- Visualization
- Scorecard

- Query, Reporting and Analysis
  - Ad hoc Analysis
  - Production reporting
  - OLAP analysis

expert systems in IIS

expert systems

problem solve

heuristics rather than algorithms

- ‘common sense’
- ‘rule of thumb’
- ‘educated guess’

knowledge in IIS

knowledge acquisition - software adds new rules

knowledge base

- facts — specific discipline
- heuristics — rules
- meta-knowledge — knowledge about knowledge

knowledge in IIS

knowledge base management system (KBMS)

- interface
- explaining facility — data related to why make this decision?
- inference engine — similar to decision table
  learn from doing

chaining in IIS

backward chaining

- start with goal
- final solution

forward chaining

- series of if-then-else

expert systems in IIS

Example use in industry:

- airline freight
- forensics DNA
- banking trends
- security trends
- agriculture diagnosis of diseases

intelligent information systems (IIS)

expert systems – why use?

- need expertise
- repeatable using rules
- successfully handled by humans
- consistent
- capacity of rules (0000's)
- low access to experts

intelligent information systems (IIS)

expert systems – issues

- too many rules
- normal systems easier
- range of topics
- disagreement in expertise
- better solved by humans

intelligent information systems (IIS)

case-based reasoning

new problem - can match a previous case & solution?

match case -> add more information -> add new case

examples:

- bank loan applications
- HP printers
  - issues & complaints
  - reduces help desk costs

intelligent information systems (IIS)

intelligent agents (bots)

adaptability	e.g. web marketing
autonomy	customer preferences
collaboration	product-brokering agents
reactive	customer alerts for new products

intelligent agents

shopping & information agents

- lower price, find sellers, specific search engines

personal agents

- automated reply messages

data mining agents

- trends in data warehouse

monitoring & surveillance agents

- track & report
- needed against failures

intelligent information systems (IIS)

fuzzy logic

degree of membership

between 0 an 1

e.g. water – is it warm, hot or cold?

used by:

- search engines
- chip design
- DBMS
- software development

intelligent information systems (IIS)

genetic algorithms (GA)

search & optimization problems

- jet engine design — input testing
- portfolio development — highest returns
- network design

- selection — weighted to find best
- crossover — combines data actions find best outputs
- mutation — combine inputs

intelligent information systems (IIS)

neural networks

not supply reason for decision

based on patterns

- use existing data
- learns model
- applies to new cases

intelligent information systems (IIS)

neural networks

- input, hidden (deep), output layers
- based on weights
  - adjusted in training

uses:

- bankruptcy predictions, credit ratings, investment analysis
- oil & gas exploration, targeted marketing

intelligent information systems (IIS)

natural language processing (NLP)

user-friendly

better human-computer communication

- interfaces
- machine translation
- summarization systems
- text generation
- speech synthesis / text-to-speech

intelligent information systems (IIS)

IS & intelligence

- adds reasoning
- access speed
- improves data management
- fuzzy data
- use of heuristics
- improved interfaces (NLP)

intelligent information systems (IIS)

Artificial Intelligence (AI)

- related technologies
- simulate & reproduce human thought behavour including:
  - thinking, speaking,
  - feeling, perception
  - knowledge, understanding
  - reasoning & cognitive abilities

AI versus IS

IS capture, store, retrieve & work with data

AI generating & displaying knowledge & facts

AI covers many subject areas, including:

- maths, psychology, economics,
- medicine, engineering, & physics

AI versus IS

IS

capture, store, retrieve & work with data

AI

generating & displaying knowledge & facts

AI covers many subject areas, including:

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AI & decision-making

what is … ?

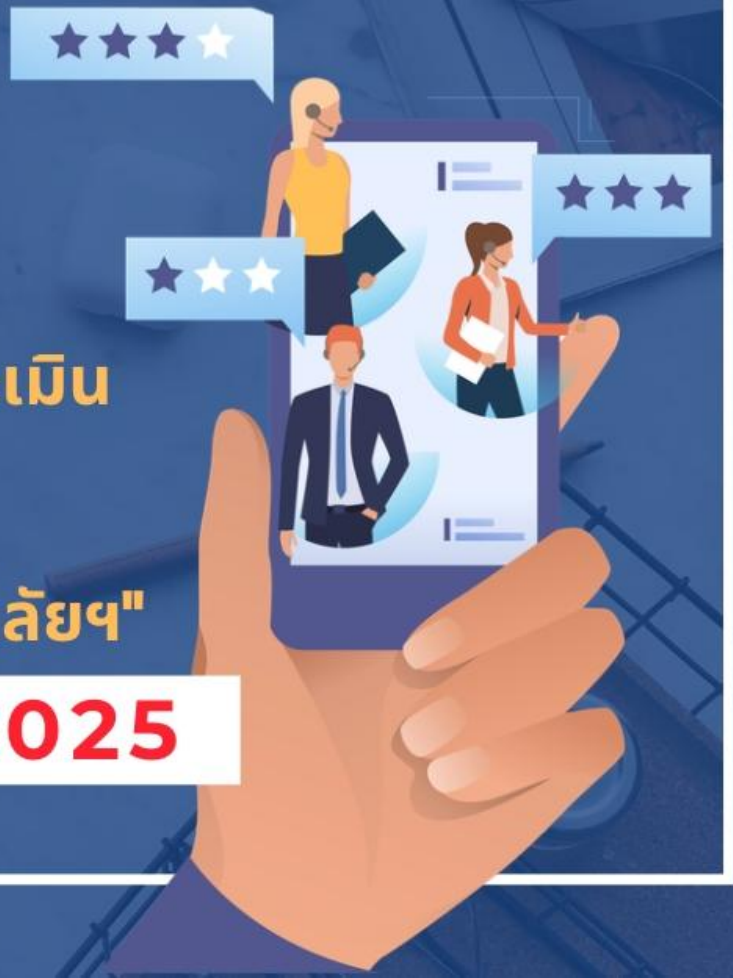
what if … ?

QA systems

Natural Language Processing

Teaching Evaluation

Dear student who have enrolled in our classes (888XXX), please would you be kind to complete an evaluation form via CMU SIS to improve the classes in the future.



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Artificial Intelligence & information systems

Social Media & Entertainment

Trend Detection

Platforms analyze user behavior to push viral challenges or trending hashtags.

Content Recommendations

Platforms like Instagram, TikTok, YouTube, and Spotify use AI to provide personalized feeds and playlists.

Filters & Editing

AI-powered filters, background removal, and video enhancements are common on Snapchat and TikTok.

Communication

Voice Assistants

Siri, Google Assistant, and Alexa help with reminders, directions, and quick internet searches.

Smart Replies

Gmail, Messenger, and other chat apps offer predictive text and auto-replies powered by AI.

e.g. Helpdesks

Education

Grammar & Writing Tools

Grammarly, Quillbot, and ChatGPT assist with assignments, essays, and brainstorming ideas.

Note Organization

AI-driven tools like Notion or Evernote recommend tags and organize content intelligently.

Study Tools & Services

Platforms like Quizlet use AI for custom practice questions and interactive learning experiences.

Shopping & Finance

Fraud Detection:

AI helps flag unusual transactions in banking apps.

E-Commerce Recommendations:

Amazon, Shein, and other retail sites suggest products based on user behavior.

Personal Finance:

Apps like Mint track spending and provide insights on financial habits.

Health

Fitness Tracking

AI in apps like Strava, Fitbit, and Nike Training Club offer personalized workout recommendations.

Mental Health Apps

AI chatbots in apps like Woebot and Youper provide conversational support for emotional well-being.

Artificial Intelligence or Machine Learning?

Improved Machine Learning

Recommendation Systems
Netflix, Spotify, and Amazon have long used ML to suggest movies or products. Now, these systems have improved using deep learning to predict user preferences more accurately.

Fraud Detection
Banks have used pattern recognition (ML) to spot fraudulent transactions for decades. Now AI-powered tools can learn dynamic behavior over time and adapt faster to new types of fraud.

Translation Tools
Google Translate initially worked based on basic ML models. Now, neural networks (like Google's Neural Machine Translation) produce more fluent and context-aware translations.

Image Recognition & Filtering
Early applications like face detection in photos (ML) have evolved into advanced facial recognition and photo tagging (AI improvements, such as Apple's FaceID).

Natural Language Processing (NLP) Assistants
Google Assistant and Siri began with scripted responses driven by simpler ML. Today, they leverage advanced AI improvements in NLP for better contextual understanding but remain largely task-based tools.

new AI

Generative AI Models (Content Creation)

- ChatGPT and Bard for natural language text generation
- DALL·E and MidJourney for image generation
- Runway and Descript for AI video editing

Synthetic Media

- Deepfakes powered by GANs create entirely realistic images or videos of people.

AI Music Composition

- Amper Music, AIVA, and Boomy create original songs without human input.

Creative AI for Code Generation

- GitHub Copilot: Writes code in real-time with advanced context-based suggestions
- Replit Ghostwriter: Similar advanced code assistance

new AI

AI-Powered Virtual Companions

Replika: AI friends that simulate meaningful conversations

Character.AI: Fully customizable chatbot interactions

Autonomous Vehicles

Tesla's Full Self-Driving (FSD) and Waymo operate based on advanced AI models beyond traditional ML image processing.

Personalized Health Diagnostics

AI-driven apps like SkinVision (early skin cancer detection)

Babylon Health for symptom checking

Medical (>ML)

- **Diagnostic Tools:** Early systems recognized patterns in X-rays or MRIs using supervised learning.
- **Electronic Health Records (EHR):** ML tools predicted treatment outcomes and flagged data inconsistencies.
- **Patient Risk Analysis:** Basic regression models identified at-risk patients for chronic diseases.

Medical (AI)

- **AI Drug Discovery:** Platforms like Insilico Medicine accelerate finding new treatments using AI simulations.
- **AI Medical Assistants:** Tools like Google's MedPaLM analyze patient data and provide diagnostic suggestions.
- **Precision Surgery:** Surgical robots like Da Vinci use real-time AI feedback for minimally invasive procedures.
- **Personalized Treatment Plans:** IBM Watson for Oncology customizes cancer treatments based on AI-driven insights from millions of case studies.

Education (>ML)

- **Learning Analytics:** Early adaptive systems like Khan Academy tracked student progress and adjusted lesson recommendations.
- **Automated Grading:** Simple ML tools graded multiple-choice assessments and detected basic plagiarism.

Education (AI)

- **AI Tutoring Systems:** Duolingo Max and Squirrel AI offer tailored lessons with generative feedback.
- **Content Creation:** AI like ChatGPT generates lesson plans, quizzes, and explanations for complex concepts.
- **Virtual Classrooms:** Synthesia enables AI-generated teachers with customizable video lessons.
- **Adaptive Assessments:** Gradescope's AI tools assess open-ended student answers beyond simple patterns.

Transport (>ML)

- **Predictive Maintenance:** ML analyzed historical data to predict when vehicles needed servicing.
- **Dynamic Pricing:** Airlines used ML models for seat pricing based on demand forecasting.
- **Route Optimization:** GPS tools predicted travel time based on traffic conditions using basic pattern recognition.

Transport (AI)

- **Autonomous Vehicles:** Tesla's FSD and Waymo operate without human drivers using neural networks.
- **AI Travel Agents:** ChatGPT plugins and tools like Hopper assist travelers with personalized itineraries and flight recommendations.
- **Smart Airports:** AI-powered facial recognition speeds up security and check-in processes.
- **Drone Delivery:** AI-driven drones from companies like Wing and Zipline enable package delivery.

Tech (>ML)

- **Predictive Analytics:** ML tools forecast sales trends based on historical business data.
- **Customer Support Bots:** Early chatbots provided basic FAQ responses using rule-based models.
- **Fraud Detection:** Pattern recognition models identified unusual payment behaviors.

Tech (AI)

- **Generative AI Assistants:** ChatGPT Enterprise, Jasper, and Bard rewrite marketing content and emails.
- **AI Code Generators:** GitHub Copilot and Replit Ghostwriter accelerate software development.
- **Business Decision Tools:** Microsoft's Azure AI analyzes customer sentiment, sales patterns, and supply chain issues.
- **Synthetic Data Generation:** Companies like Mostly AI use synthetic datasets to test AI models without using real customer data.

Marketing (>ML)

- **Audience Targeting:** Predictive algorithms for personalized ad targeting on platforms like Google Ads.
- **Email Campaign Optimization:** ML tools analyzed customer engagement to optimize email send times and content.

Marketing (AI)

- **Generative AI for Content:** Jasper and Copy.ai generate social media posts, blogs, and ad copy.
- **AI-Powered Analytics:** Platforms like Hunch analyze market trends in real-time for better ad decisions.
- **Visual Content Generation:** DALL·E and MidJourney create ad creatives from scratch.

Supply Chain (>ML)

- **Inventory Forecasting:** ML predicted stock levels based on sales patterns.
- **Route Optimization:** Logistics firms used pattern-based systems for delivery route planning.

Supply Chain (AI)

- **Real-Time Supply Chain Monitoring:** AI-powered IoT systems predict disruptions.
- **Autonomous Warehousing:** Robots powered by AI (like those from Boston Dynamics) manage warehouse tasks.
- **Predictive Demand Forecasting:** Platforms like Blue Yonder use AI to predict market demand.

Thank you!

any questions?