

Cognitive Computing

UCS420

Lecture-1

Course Instructors

Dr. Anjula Mehto and Dr. Manisha Malik

Assistant Professor, CSED

Email-anjula.mehto@thapar.edu, manisha.malik@thapar.edu

Course Credit

Course Name: Cognitive Computing

Course Code: UCS420

Course Credit- 3.0

L	T	P	Cr
2	0	2	3.0

Course Objective

- This course will provide advanced students in cognitive science and computer science with the skills to develop computational models of human cognition, giving insight into how people solve challenging computational problems, as well as how to bring computers closer to human performance.

Syllabus

- **Foundation of Cognitive Computing:** Understanding cognition, Cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence (AI) as the foundation of cognitive computing, Applications of cognitive computing
- **Cognitive System Design Principles:** Components of a cognitive system, building the corpus, bringing data into cognitive system, Machine learning based design, Hypothesis generation and scoring, Introduction to Natural language processing (NLP), Taxonomies and Ontologies
- **Reasoning and Learning:** Case based reasoning, Analogical reasoning, Constraint reasoning and Meta reasoning, Concept learning, Common sense-based learning, Explanation based learning
- **Advance Analytics:** Big data and Cognitive computing, Predictive Analytics, Text Analytics, Image Analytics, Speech Analytics
- **Case Studies:** Cognitive Systems in health care, Cognitive Assistant for visually impaired People, IBM Watson–Introduction to IBM's Power AI Platform, Cognitive Systems in Finance: Cognitive banking services using virtual agents

Recommended books

Text Books:

- Judith S., Kaufman M., and Bowles A., Cognitive Computing and Big Data Analytics, Wiley, (2005), 1st ed.
- Fingar P., Cognitive Computing: A Brief guide for Game Changers, Meghan-Kiffer Press, (2014), 1st ed.

Reference Books:

- Miller J., Learning IBM Watson Analytics, Packt Publishers, (2016), 1st ed.
- Hashmi A. and Masood A., Cognitive Computing Recipes: Artificial Intelligence solutions using Microsoft Cognitive Services and Tensorflow, Apress, (2019), 1st ed.
- Kashyap P., Machine Learning for Decision Makers: Cognitive Computing Fundamentals for better decision making, Apress, (2018), 1st ed.

COURSE LEARNING OUTCOMES (CLOs)

After the completion of the course, the student will be able to:

CLO1: Understand and discuss what cognitive computing is, and how it differs from traditional approaches.

CLO2: Understand various design principles for cognitive computing.

CLO3: Plan and use various primary tools associated with cognitive computing.

CLO4: Implement various analytics tools in related areas of computer science.

CLO:5 Describe various case studies related to cognitive computing.

Evaluation scheme

- MST: 35 marks (Weightage -30%)
- Sessional marks: 30 marks (Weightage -30%)
 - Sessional quiz- 10 marks (before MST)
 - Lab evaluation- 20 marks (before EST)
- EST: 50 marks (Weightage -40%)

Why we are studying this course ?

1. You understand the basic principles of Cognitive Computing.
2. You broaden your horizon, to learn and explore.

How to pass this course ?

1. Attendance is MANDATORY!!!
2. Do Lab assignment on time.
3. Learning attitude

Please Note

- Please come on Time. A buffer of 5 minutes will be allowed.
- Attendance is mandatory.
- **If you want to talk, kindly leave the classroom without disturbing others.**
- We aim to keep the class engaging and interactive.

Contact

Preference on EMAILS:

Email: anjula.mehto@thapar.edu, manisha.malik@thapar.edu

Mode of contact would be email ONLY!!!

No whatsapp!! Or calls!!!! (Only CR or GR can call)

Let's learn about Cognitive Computing

Computers - solve problems, analyze language, and even predict outcomes

Voice Assistants and Smart Devices

Have you heard of Siri, Alexa, and Google Assistant?

"When you ask Siri to set an alarm or play a song, the system processes your voice, understands the command, and responds accordingly. That's cognitive computing!"


Real-World Examples

Instagram/Facebook Feeds

Have you noticed how Instagram shows you posts and reels you're most likely to enjoy?


Cognitive systems analyze your preferences, time spent on posts, and interactions to personalize your feed.

Shopping and E-commerce


**amazon.com**

Recommended for You


Amazon.com has new recommendations for you based on [items](#) you purchased or told us you own.



[Google Apps Deciphered: Compute in the Cloud to Streamline Your Desktop](#)



[Google Apps Administrator Guide: A Private-Label Web Workspace](#)



[Googlepedia: The Ultimate Google Resource \(3rd Edition\)](#)

- Set patterns



Remember those school textbook exercises that followed predetermined learning paths? They may lack the capability to adapt to individual learning styles.

- Cognitive computing is one such technology that can evaluate an individual's performance and offer personalized recommendations.

- Personalized recommendations



Cognitive

- Pertaining to the processes of **thinking, reasoning, understanding, and learning (intellectual activities)**
- Examples of cognition include:
 - *paying attention to something in the environment,*
 - *learning something new,*
 - *making decisions,*
 - *processing language,*
 - *sensing and perceiving environmental stimuli,*
 - *solving problems, and*
 - *using memory.*



Cognitive Computing

- Cognitive computing-
 - Attempts to mimic the way a human brain works.
 - Has already generated household names such as Apple's Siri and Amazon's Alexa.
 - Focuses on building systems that **augment human intelligence**, helping humans make better decisions.
 - Example- Apple's Siri and Amazon's Alexa, Chatboat-Many websites have chatbots that help answer your questions.

Cognitive Computing

- Cognitive: Intellectual activities
 - Thinking
 - Reasoning
 - Problem-solving

Cognitive

- Cognitive computing: Technology to mimic human cognitive processes





Cognitive computing

- Makes machines active partners, not just tools.
- These advanced systems do more than execute commands.
 - Grasp your needs,
 - Anticipate your questions, and
 - Proactively deliver valuable insights.

For instance, the cognitive computing system can help a bank detect fraudulent transactions, or it can be employed by a company to improve its customer support through the chat bot.



Introduction to Cognitive Computing

- Cognitive computing is a technology that mimics human thought processes using artificial intelligence (AI), machine learning (ML), natural language processing (NLP), and data analytics.
- Cognition-
 - Mental action or process of acquiring knowledge by understanding thought, experience and the senses.
- Cognitive processes use existing knowledge and generate new knowledge.
- Cognitive process continuously acquire knowledge from the data to understand human interaction and provide answers.



AI vs Cognitive Computing

AI	Cognitive Computing
Focuses on building systems that replace human intelligence for automating tasks and decision-making.	Focuses on building systems that augment human intelligence , helping humans make better decisions.
AI often works autonomously to solve problems.	Cognitive Computing collaborates with humans to assist in problem-solving.

Cognitive Computing as part of AI

- **AI's Scope:** AI encompasses all intelligent systems, including ones that don't aim to mimic human thought (e.g., optimization algorithms, robotic process automation).
- **Cognitive Computing's Focus:** Narrowly targets systems that interpret data, reason, and interact naturally, aiming to enhance human decision-making.

"Is a self-driving car an AI system or a cognitive system?"

Self Driving cars

- **Cognitive Computing:** Assists humans in decision-making and requires human interaction.
- **Self-Driving Cars:** Use **AI** to act autonomously, replacing the human driver.
- In summary, **self-driving cars are AI-driven systems, not examples of cognitive computing.**

- A **medical diagnostic tool** (e.g., IBM Watson Health), on the other hand, is a cognitive system as it aids doctors by reasoning, learning, and providing insights in a human-like manner.

Human Understanding & Cognitive Computing

When we as humans seek to understand something and to make a decision, we go through four key steps:

- First, we observe visible phenomena and bodies of evidence.
- Second, we draw on what we know to interpret what we are seeing to generate a hypothesis about what it means.
- Third, we evaluate which hypotheses are right or wrong.
- Finally, we decide choosing the option that seems best and acting accordingly.

*Just as humans become experts by going through the process of observation, evaluation, and decision-making, **cognitive systems use similar processes to reason about the information they read, and they can do this at massive speed and scale.***

Core Elements of Cognitive Computing



Perception



Learning



Reasoning

Perception

Perception is the basis of cognitive computing to interpret and understand the environment. The components of perception include sensing, where data, whether **structured or unstructured**, is gathered from various sources.



Interprets the environment



Gathers data



Structured/unstructured data

Learning

Machine learning algorithms



Analyze data



Extract meaningful insights

Cognitive computing employs machine learning algorithms to analyze the data and extract meaningful information from the data.

Accurate predictions



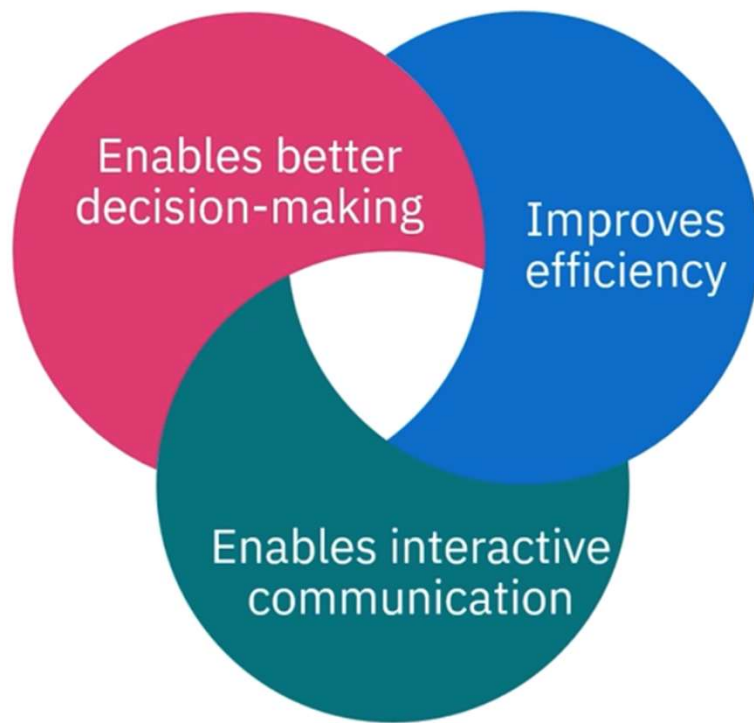
Analyzes patterns and trends



Provides insight into complex relationships



Benefits of Cognitive Computing



- Elevated decision-making due to the analysis of huge datasets
- Improves efficiency, as it saves time and resources by automating tasks
- Enables more human-like and interactive communication between machines and humans with the help of natural language processing.

Cognitive computing has multiple applications from healthcare and finance to education and entertainment.



Healthcare

Finance



Education

Entertainment



Several companies across various industries are using cognitive computing technologies to enhance their products, services, and operations. Some notable examples include IBM Watson, which uses cognitive computing in the fields of healthcare, finance, retail, and customer service

IBM Watson:



Google utilizes cognitive computing techniques in its products and services, including Google Search, Google Assistant, and Google Translate

Google:

Google Search



Google Assistant



Google Translate



Amazon's Alexa virtual assistant employs cognitive computing to understand and respond to voice commands, manage smart home devices, and provide personalized recommendations to users

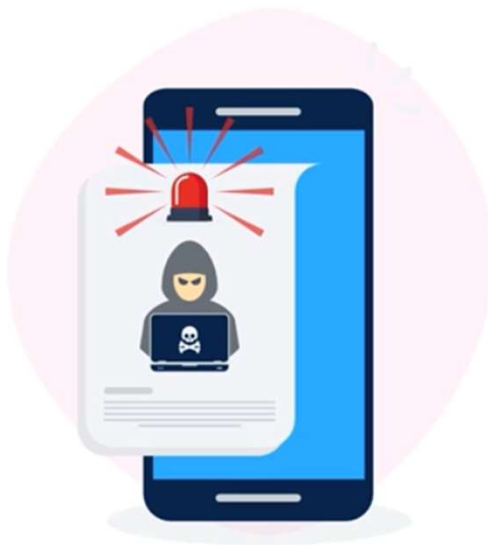
Amazon:



JPMorgan Chase (JPMC) and Wells Fargo use cognitive computing to detect fraud, assess risk, and automate customer service.

JPMorgan Chase and Wells Fargo:

Fraud detection



Risk assessment



Customer service
automation





- Cognitive computing: Mimics human cognitive processes like thinking, reasoning, and problem-solving
- Core elements:
 - Perception: Gathering and interpreting data from various sources
 - Learning: Using machine learning algorithms to analyze data
 - Reasoning: Making accurate predictions and decisions based on data analysis



- Benefits:
 - Better decision-making
 - Improved efficiency
 - Interactive communication
- Companies using cognitive computing:
 - IBM
 - Google
 - Amazon
 - JPMorgan Chase
 - Wells Fargo