**MCSE 666: Assignment 01**

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Q1. What do you mean by Pattern? List Several Examples of Pattern in Real Life, especially Daily Life.

***Answer:***

***A pattern*** is a recurring sequence of features that can be used to identify or classify an object or event. A pattern is a regularity or similarity that can be observed in data, signals, images, or other types of information. Patterns can be used to classify, analyze, compress, or generate new data. Patterns can also be a design or set of shapes that show how to make something [[1](#Bookmark1)].

Patterns are designs in which lines, shapes, forms or colours are repeated. The part that is repeated is called a motif, Patterns can be regular or irregular [2]

**Regular patterns** are patterns in which the motif (or motifs) is repeated in a way that is predictable. It could be the same each time, or it could change in a way that is regularly repeated. There are many ways to arrange motifs to create a regular pattern, such as using grids, rotations, reflections, translations. Regular patterns refer to those that follow a predictable and consistent repetition of elements at fixed intervals. These patterns exhibit a high degree of order and can be easily identified or predicted. In mathematics, a regular pattern can often be represented by a simple mathematical formula. Regular patterns can be found in various aspects of daily life. [2] [4]

**Irregular patterns** are patterns in which the motif changes or the way it is repeated is unpredictable. The motif may vary in size, shape, colour, orientation or position. Irregular patterns can create a sense of variety, movement, spontaneity or chaos. Irregular patterns, on the other hand, lack a predictable repetition and display a more random or chaotic distribution of elements. They do not follow a fixed interval and are less structured compared to regular patterns. In mathematics, irregular patterns might be challenging to represent with a simple formula. [4] [5]

For example, a pattern in an image can be a shape, a colour, a texture, or an object. A pattern in a signal can be a frequency, a waveform, a modulation, or a noise. A pattern in data can be a correlation, a distribution, a trend, or an outlier. Patterns can be simple or complex, depending on the level of abstraction and the number of features involved.

***Some real-life examples of regular patterns in daily life are:***[2] [4] [5]

The stripes on a zebra or a tiger, The tiles on a floor or a wall, The bricks on a building or a pavement, [2]. The musical notes on a sheet or a song, The calendar dates on a year or a month [4] [5] etc.

**Daily Routines:** Many people follow regular patterns in their daily routines, such as waking up and going to bed at the same time each day or having meals at specific intervals.

**Clocks and Calendars:** Timekeeping devices, such as clocks and calendars, display regular patterns with consistent intervals for hours, minutes, days, weeks, and months.

**Traffic Signals:** Traffic signals follow a regular pattern of changing colors at fixed intervals to control vehicular movement at intersections.

**Musical Beats:** Music often has a regular pattern of beats, with specific rhythms and time signatures, creating a structured and predictable flow.

**Seasonal Changes:** Seasonal patterns, like the changing of weather and temperatures throughout the year, occur in a cyclic and predictable manner.

[***Some real life examples of irregular patterns in daily life are:***](https://www.bbc.co.uk/bitesize/guides/z3c4jty/revision/3)[2] [4] [5]

The cracks on a broken glass or a pottery, The clouds on the sky or the stars on the night, The leaves on a tree or the flowers on a field, The splashes on a painting or the drips on a faucet, The freckles on a face or the spots on a leopard. [4]

**Random Noise:** Environmental sounds, like the noise of traffic, birds chirping, or waves crashing on a beach, often exhibit irregular patterns without a consistent rhythm.

**Natural Landscapes:** The arrangement of trees, rocks, and plants in a forest or a garden might appear irregular, lacking a repetitive structure.

**Crowd Movement:** In a crowded area, such as a market or a busy street, the movement of people might follow irregular patterns, influenced by individual decisions and interactions.

**Seismic Activity:** Earthquakes and aftershocks can occur unpredictably and do not follow a regular pattern in terms of timing or magnitude.

**Stock Market Fluctuations:** The stock market can experience irregular patterns with fluctuations and unpredictable shifts in prices.

***Other examples of patterns are - [2]***

**Natural patterns:** The stripes on a zebra, The spots on a leopard, The scales on a fish, The petals of a flower, The rings of a tree, Weather and Seasons: The four seasons - winter, spring, summer, and fall - This cycle repeats every year. Day and night: This cycle repeats every 24 hours.[6]

**Geometric patterns:** The checkerboard pattern on a tablecloth, The stripes on a flag, The grid pattern on a piece of paper, The spiral pattern of a galaxy, The fractal pattern of a snowflake,

**Object Shapes:** Many objects are made of shapes that form a pattern. For example, a quilt can have a pattern of squares or triangles. Tiles on the floor or wall can also form a pattern. Patterns that are made of geometric shapes and don’t overlap are called tessellations

**Language patterns:** The grammar of a sentence, The syntax of a paragraph, The semantics of a word, The pragmatics of a conversation, The patterns of human speech. Literature: For example, in poems and sonnets.

**Sound patterns:** The rhythm of a song, The melody of a tune, The harmony of a chord progression, The structure of a piece of music, The patterns of sound waves.[1](https://lisa-andersen.com/what-are-examples-of-patterns-in-real-life/)

**Behavioural patterns:** The daily routine of a person, The habits of an animal, The patterns of traffic, The patterns of weather, The patterns of human behaviour.

***References of Sources:***

[1] <https://www.bbc.co.uk/bitesize/guides/z3c4jty/revision/3> and Pattern - definition of pattern by The Free Dictionary <https://www.thefreedictionary.com/pattern>, and [Pattern - Wikipedia](https://en.wikipedia.org/wiki/Pattern) as visited on 26/07/2023.

[2] [Patterns in Everyday Activities | DREME TE (stanford.edu)](https://prek-math-te.stanford.edu/patterns-algebra/patterns-everyday-activities) , Patterns in Everyday Activities | DREME TE - Stanford University https://prek-math-te.stanford.edu/patterns-algebra/patterns-everyday-activities ; as visited on 26/07/2023.

[3] <https://www.byjusfutureschool.com/blog/what-are-some-examples-of-patterns-in-real-life/> as visited on 26/07/2023.

[4] [Regular patterns - Pattern - National 5 Art and Design Revision - BBC Bitesize](https://www.bbc.co.uk/bitesize/guides/z9vv39q/revision/3) as visited on 26/07/2023.

[5] [Irregular pattern - Pattern - AQA - GCSE Art and Design Revision - AQA - BBC Bitesize](https://www.bbc.co.uk/bitesize/guides/z3c4jty/revision/3) as visited on 26/07/2023.

[6] Seasons: Earth’s Tilt | National Geographic Society <https://www.nationalgeographic.org/article/seasons-earth-tilt/> as visited on 26/07/2023.

**Q 2. What is your KNOWLEDGE expectation from the course?**

***Answer:***

In the context of Pattern and Speech Recognition in the field of Computer Science and Engineering (CSE), a "pattern" refers to a regular, consistent, or repeating arrangement of data or features in a particular format. Patterns can be observed in various types of data, such as images, speech signals, text, or any other structured information. Pattern recognition is the process of finding patterns and regularities in data. It is a branch of computer science that has applications in many fields, such as data analysis, signal processing, image analysis, machine learning, and information retrieval. Pattern recognition also refers to a cognitive process that matches information from a stimulus with information from memory. Pattern recognition can help us solve complex problems more efficiently by finding similarities among smaller problems. Pattern recognition aims to identify and categorize these patterns automatically, often using machine learning and statistical techniques.

***Some examples of pattern recognition and some specific research ideas that could be explored in an Automation AI ML IDSS, System Optimization thesis research:***

1. Feature Vectors: Representations of patterns in a multidimensional space, where each dimension corresponds to a specific characteristic or attribute of the pattern. These feature vectors are used as input to various pattern recognition algorithms.

2. Classification: The process of assigning a label or category to a given pattern based on its features. This is a fundamental task in pattern recognition.

3. Clustering: Grouping similar patterns together based on their feature similarities without predefined labels.

4. Template Matching: Comparing a pattern with predefined templates to find the best match.

5. Regression: Assigning a real-valued output to an input value based on a mathematical function. For example, predicting the price of a house based on its features.

6. Dimensionality reduction: Reducing the number of features or dimensions of the input data while preserving its essential information. For example, compressing an image or a sound file.

7. Anomaly detection: Finding outliers or abnormal input values that deviate from the expected pattern. For example, detecting fraud or intrusion in a network.

Attending the Pattern Recognition MCSE course can provide valuable knowledge related to Automation, AI, ML, IDSS, and System Optimization.

***Some key areas of knowledge one can gain from the course that are relevant to these fields:***

1. Identify a research problem, Literature review, Research design.
2. Data collection and analysis.
3. Theoretical foundation and Problem-solving skills.
4. Technical skills to conduct research with patterned data.
5. Machine Learning Algorithms for Pattern Recognition Techniques.
6. Data Preprocessing and Feature Engineering.
7. Model Evaluation and Optimization.
8. System Optimization. with Intelligent Decision Support Systems (IDSS).
9. Case Studies and Applications.

***Q3. What is your GRADE expectation from the course?***

***Answer:***

I expect to get a GPA of 4.00, Grade A+ from this course.