Lesson 2: Fourth Industrial Revolution

- **Characteristics:**
  - **Technologies:** AI, robotics, IoT, 3D printing, quantum computing.
  - **Impact:** Blurring lines between physical, digital, and biological spheres.
  - **Examples:** Smart factories, autonomous vehicles, personalized medicine.
  - Quiz 1: Exponential Evolution of Technology |
  - Quiz 2: https://www.coursera.org/learn/bcg-uva-darden-digital-transformation/lecture/OChsy/deconstruction-of-the-value-chain

Use of any handset instead of network service provided one

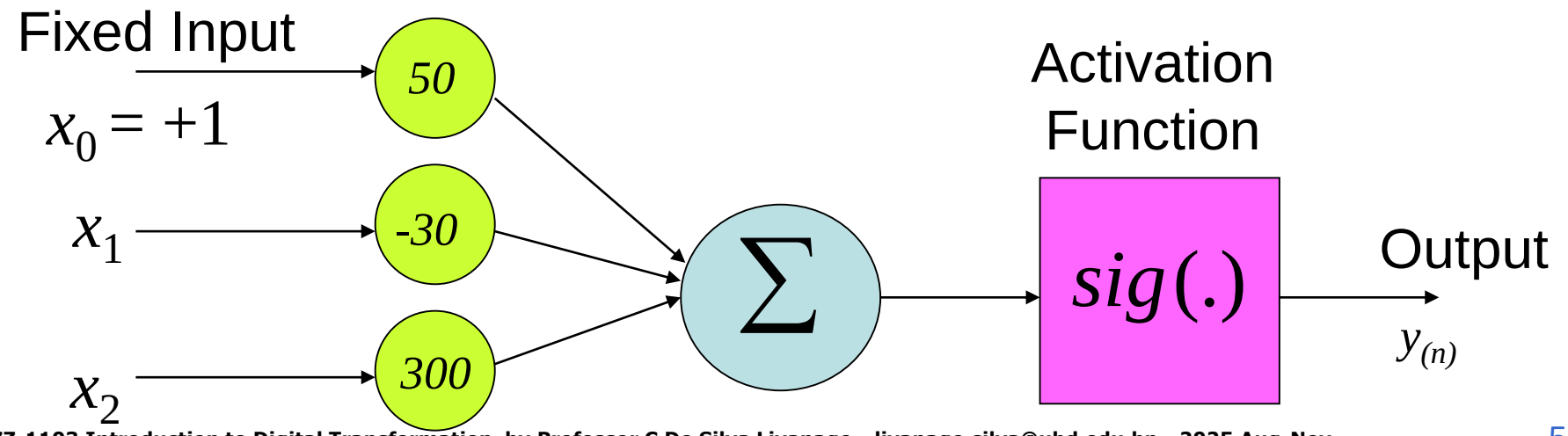
- **Why legal battle to use any handset instead of network service provided one finished in mid 50s applied only in early 20's?**
  - The technology to use non-network service provider handsets was available in the early 20s, but the legal battle to allow customers to use these handsets was settled in the mid-50s.
  - This means that even though the technology existed earlier, it took several decades for the legal issues to be resolved and for customers to have the freedom to use handsets not manufactured by their network service provider.

- **The legal battle to allow customers to use handsets not manufactured by their network service provider took a long time for several reasons:**
  - **Regulatory Framework: The telecommunications industry is heavily regulated, and changes to regulations often require extensive legal processes and negotiations.**
    - **It took time for the regulatory framework to evolve and adapt to the changing technological landscape.**

- **Industry Resistance: The network service providers had a vested interest in maintaining control over the handsets used on their networks.**
  - **They may have resisted changes that would allow customers to use non-network service provider handsets, as it could potentially disrupt their business models and revenue streams.**
- **Technological Limitations: While the technology to use non-network service provider handsets may have been available in the early 20s, it may not have been widely adopted or compatible with existing network infrastructure.**
  - **It took time for the technology to mature and for the industry to develop standards that would allow for interoperability between different handsets and network providers.**
- **Legal Challenges: Legal battles can be complex and time-consuming.**
  - **It may have taken several years for the legal issues surrounding the use of non-network service provider handsets to be fully resolved, with multiple court cases, appeals, and negotiations involved.**

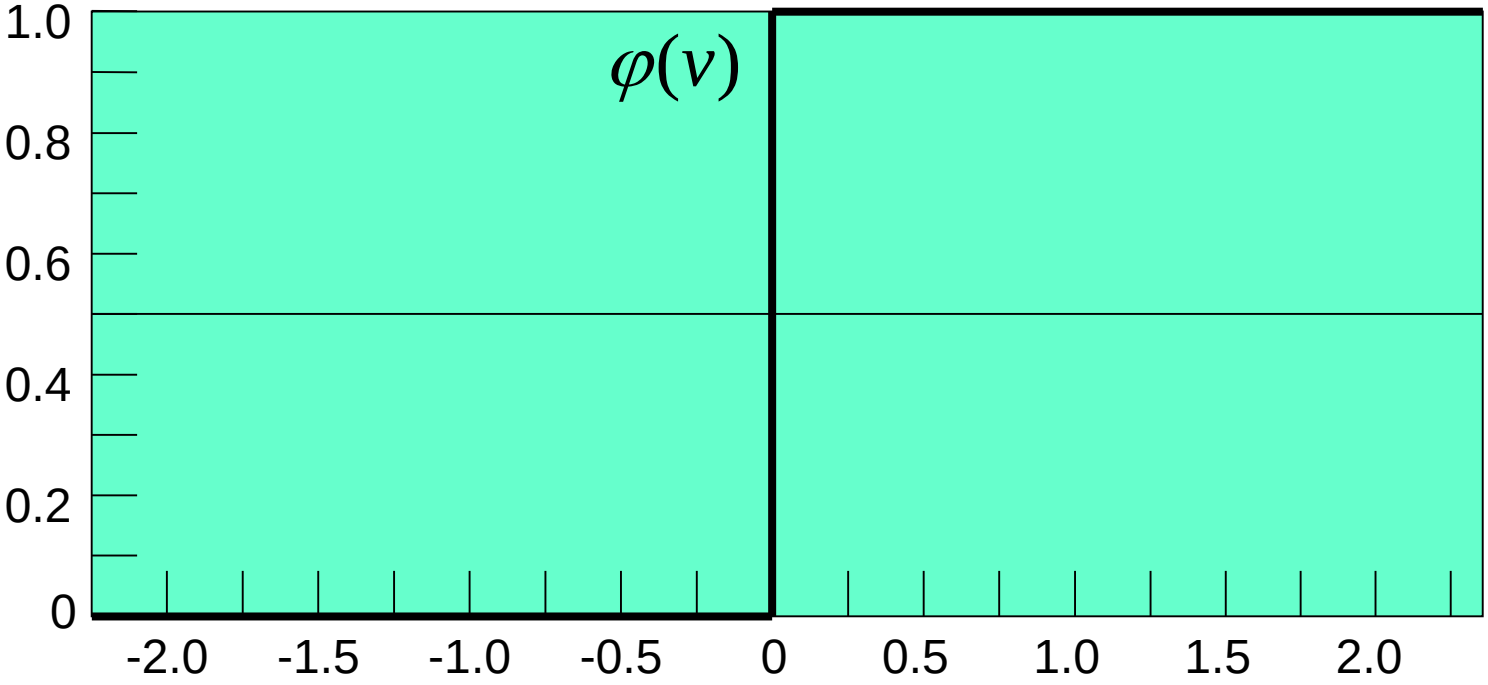
Quiz – Exponential Evolution of Technology

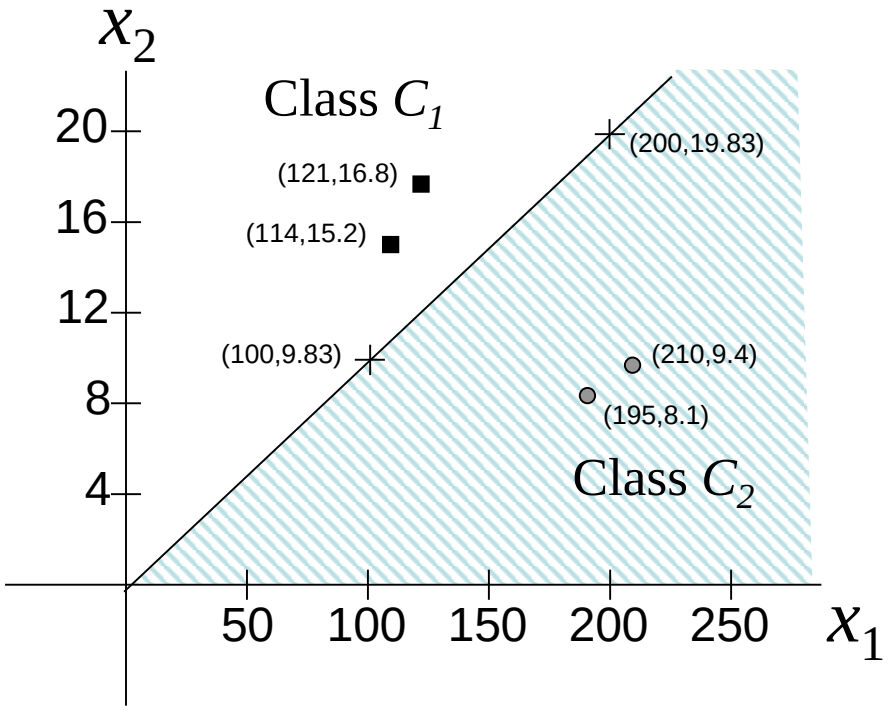
	Weight (grams)	Length (cm)
Fruit 1	121	16.8
	114	15.2
Fruit 2	210	9.4
	195	8.1



Heaviside Function

$$\varphi(v) = \begin{cases} 1 & \text{if } v \geq 0 \\ 0 & \text{if } v < 0 \end{cases}$$




x_2
Class C_1
20
16
12
8
4
(121,16.8)
(114,15.2)
(200,19.83)
(100,9.83)
(210,9.4)
(195,8.1)
Class C_2
50
100
150
200
250
x_1

Sample Question:

- Explain how digital transformation can be applied to the process of **classifying apples and bananas** using weight and length as features.
- Specifically, discuss how a Neural Network can be trained for this classification task.
- What are the key steps involved in this process, and how does leveraging digital transformation technologies enhance the efficiency and accuracy of the classification?

Sample Answer:

- Digital transformation leverages advanced technologies to improve and streamline processes, using machine learning techniques.
- In this context, we can use a Neural Network to classify the fruits based on their weight and length.

Sample Answer: (Cont…)

- The key steps involved in this process are as follows:
  - **Data Collection:** The first step is to collect a dataset containing measurements of weight and length for a variety of apples and bananas. This dataset should be labeled, meaning each entry should specify whether the fruit is an apple or a banana.
  - **Data Preprocessing:** The collected data needs to be cleaned and normalized to ensure consistency and improve the performance of the Neural Network. This involves handling any missing values, scaling the features (weight and length) to a similar range, and possibly splitting the data into training and testing sets.

Sample Answer: (Cont…)

- **Feature Selection:** In this case, we have already chosen the features – weight and length. These features are used as inputs to the Neural Network.
- **Model Design:** Design the architecture of the Neural Network. A simple Neural Network for this classification task might consist of an input layer with two nodes (one for weight and one for length), one or more hidden layers, and an output layer with two nodes (one for apple and one for banana).

Sample Answer: (Cont…)

- **Training the Model:** The training process involves feeding the training data into the Neural Network and adjusting the weights through backpropagation to minimize the classification error.
- **Model Evaluation:** After training, the model needs to be evaluated using the testing set to assess its accuracy and generalization capability.
- **Deployment:** Once the model has been trained and evaluated, it can be deployed in a real-world application. This might involve integrating the model into a system that automatically classifies apples and bananas based on new measurements of weight and length.

Sample Answer: (Cont…)

- By leveraging digital transformation technologies, we can automate the classification process, making it faster and more accurate compared to manual methods.
- The use of Neural Networks, a key component of artificial intelligence, allows us to handle complex patterns and relationships in the data, leading to improved classification performance.
- Additionally, digital transformation enables the continuous collection and integration of new data, allowing the model to be retrained and updated regularly to maintain high accuracy.

Fourth Industrial Revolution

- **IR:**
  - **https://www.coursera.org/learn/industry-4-point-0-and-its-impact-on-manufacturing-sector/lecture/dCxaC/from-agrarian-economy-to-manufacturing-economy**
  - https://www.coursera.org/learn/industry-4-point-0-and-its-impact-on-manufacturing-sector/lecture/md13u/moving-from-industry-1-0-to-industry-3-0
  - After watching the above videos please answer the 2025 Quiz 3 (IR1.0 to IR3.0)