

香港中文大學 The Chinese University of Hong Kong

Т

## ENGG1004N/K Digital Literacy and Computational Thinking

### Lecture I: Digital Technologies

Term 2, 2024-25

Wai-Yiu Keung

wykeung@cse.cuhk.edu.hk

### Overview

Digital Technologies and Breakthroughs

CUHK Library Digital Services

Implications and Digital Security

Cloud Computing with Virtual Machine

• Al Generation

# **Digital Technologies**

Represent data using discrete numbers and digits that can be recorded, stored and processed as well as reproduced exactly

Digital data, bits and bytes, can be captured, processed, stored and presented using electronic and optical means



lılı,

Creative models, novel strategies and innovative devices made it happen



 Semiconductors enable powerful computing  Data storage evolved from physical drives to cloud storage  Networking advancements connect devices globally

### Chips: Moore's Law

 "Transistor density on integrated circuits doubles about every two years."

### 1950s

Silicon Transistor



1 Transistor



1960s

16

Transistors

8-bit Microprocessor

1970s



4500 Transistors

1980s

32-bit Microprocessor



275,000 Transistors

32-bit Microprocessor



3,100,000

Transistors



2000s

64-bit

Microprocessor

592,000,000 Transistors

1990s



### Moore's Law: The number of transistors on microchips doubles every two years Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.



OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the authors Hannah Ritchie and Max Roser.

# Storage: Price of Storage Devices







### HK\$500@2000

HK\$30@2010

HK\$54@2023

# smaller; BIGGER; Cheaper

### Network: Wired Communications





- O Coaxial / Twisted-Pair Cable
- Fibre optics for communication
- Invented by <u>Prof Charles K.</u>
  <u>Kao</u> and George A. Hockham in 1965

### Network: Wireless Communications



- Microwave Link (e.g. Satellite)
- GSM, 4G, 5G and WiFi
- Bluetooth and Near-Field Communication (NFC)
  - E.g. Octopus, PayWave, Apple Pay etc.

### Tech. Resources in CUHK



Office 365 Suite



### Duo Two Factor (2FA) Authentication



### **Off-Campus User Authentication**

The off-campus access to e-resources subscribed by the Chinese University of Hong Kong Library is restricted to current CUHK students, faculty or staff.

Security reminder Please remember to close all your browsers before leaving your computer.



E-resources at Library



Wi-Fi Access Capability





HOW RELIABLE ARE THESE TECHNOLOGIES? WHAT ARE THE IMPACTS? WHAT ARE THE COSTS?

WHAT ARE THE RISKS?

# Contemporary Developments ABC

OArtificial Intelligence (Machine Learning)

 Deep learning enables a lot of computer applications that previously can only be achieved by human

○ Big Data (Data Science)

Data mining and applications

Cloud Computing (Virtual Machine)
 Infrastructure, Platform, Software as a Service

# Artificial Intelligence

- An evolved form of digital technology
- Generative Al
  - Al-assisted comprehension, classification, composition and creation
  - Multi-model: text, image, video, sound, etc.

## Big Data with IoT and AloT

### Internet of Things (IoT)

- Connecting everything to the Internet
- Collect lots of data
- Control things remotely
- Continuous monitoring
- Collaborative gadgets



 ○ Think of Smart Lamppost, Face Boarding, HKeToll, AirTag<sup>™</sup>, etc.

## Cloud Computing

- Daily services: cloud-based storage/drive, photo album, notes-taking, calendar, etc.
- Major take-away: CUHK subscribes to Microsoft Azure Labs Service
  - Provides a Virtual Machine (VM) for each of us!

• How does it work? Does it concern me?

## Class Activity – Pre-Lab

- $\odot$  You can enjoy using a Microsoft VM licensed by CUHK
- Check your CWEM (@link) email box for an invitation, possibly check also junk/ spam folder
- Read the agreement and CLICK the registration link
- Login using your <u>SID@link.cuhk.edu.hk</u> account and CUHK
  OnePass
- In the future: Start/ Stop/ Reset your VM through <a href="https://labs.azure.com/virtualmachines">https://labs.azure.com/virtualmachines</a>



### Setup/ Reset VM Password

VM Username is default to be dlct

• VM Password is **SET BY YOU NOW** 

Shall be DIFFERENT from your OnePass

• It takes a moment to be effective...



### Virtual Machine on Cloud

• Virtually/ logically, it is a PC, but without physical access

○ It has logical hardware components, e.g.,

- 8-core Xeon CPU
- I6GB RAM
- Disk storage
- Networking capability
- Even GPU in some setups
- Pre-installed with an operating system (OS) and some application software
- It is provided on demand user Start and Stop
- It can be used through Remote Desktop

### Virtual Machine Software

Operating System such as Windows is bundled
 Possible to provision another OS such as Linux
 Pre-installed software such as
 Microsoft Office – you shall login O365
 Python IDLE and RStudio
 Anaconda

- Jupyter Notebook
- Orange Data Mining

### AI Generation

- We are somehow in an "AI Generation"
- AI provides solutions and outputs from pre-trained models (e.g. ChatGPT and many other large language models)
- How those models were built, and how to make use of such models?

## How People Use AI





### Make a guess: Which one is a fake photo of Trump?

### Core Idea of This Course



• we collect, record, process, interpret digital data

 $\circ$  we learn to make correct and efficient use of digital tech.