LECTURER: TAI LE QUY

ARTIFICIAL INTELLIGENCE

TOPIC OUTLINE

UNIT 5

APPLICATIONS OF ARTIFICIAL INTELLIGENCE

STUDY GOALS

On completion of this unit, you will have learned …

- … how artificial intelligence techniques will aid the coming mobility revolution.
- … about the ways the medicine and health care sectors can benefit from artificial intelligence.
- … to distinguish between the multitude of ways artificial intelligence is used to support current financial processes as well as enable entirely new business models in the financial sector.
- … how artificial intelligence is employed in retail to automize workflows, optimize supply chains, and help in tailoring services to customers.

EXPLAIN SIMPLY

1. Explain the concept of blockchain. How does cryptocurrency relate to it?
2. Describe some of the improvements the industry is experiencing through the use of AI.
3. Name a future mobility trend and explain what kind of impact AI will have.

EMERGING MOBILITY TRENDS

- Car and ridesharing and the general trend away from vehicle ownership
- The development of autonomous vehicles equipped with sensing devices to support driverless mobility
- Advances in networking between different modes of transport, such as trains, trolleys, and busses, creating a seamless journey spanning multiple modalities
- In the future, mobility is likely to evolve further to become more personalized, interconnected and sustainable (**smart mobility**)

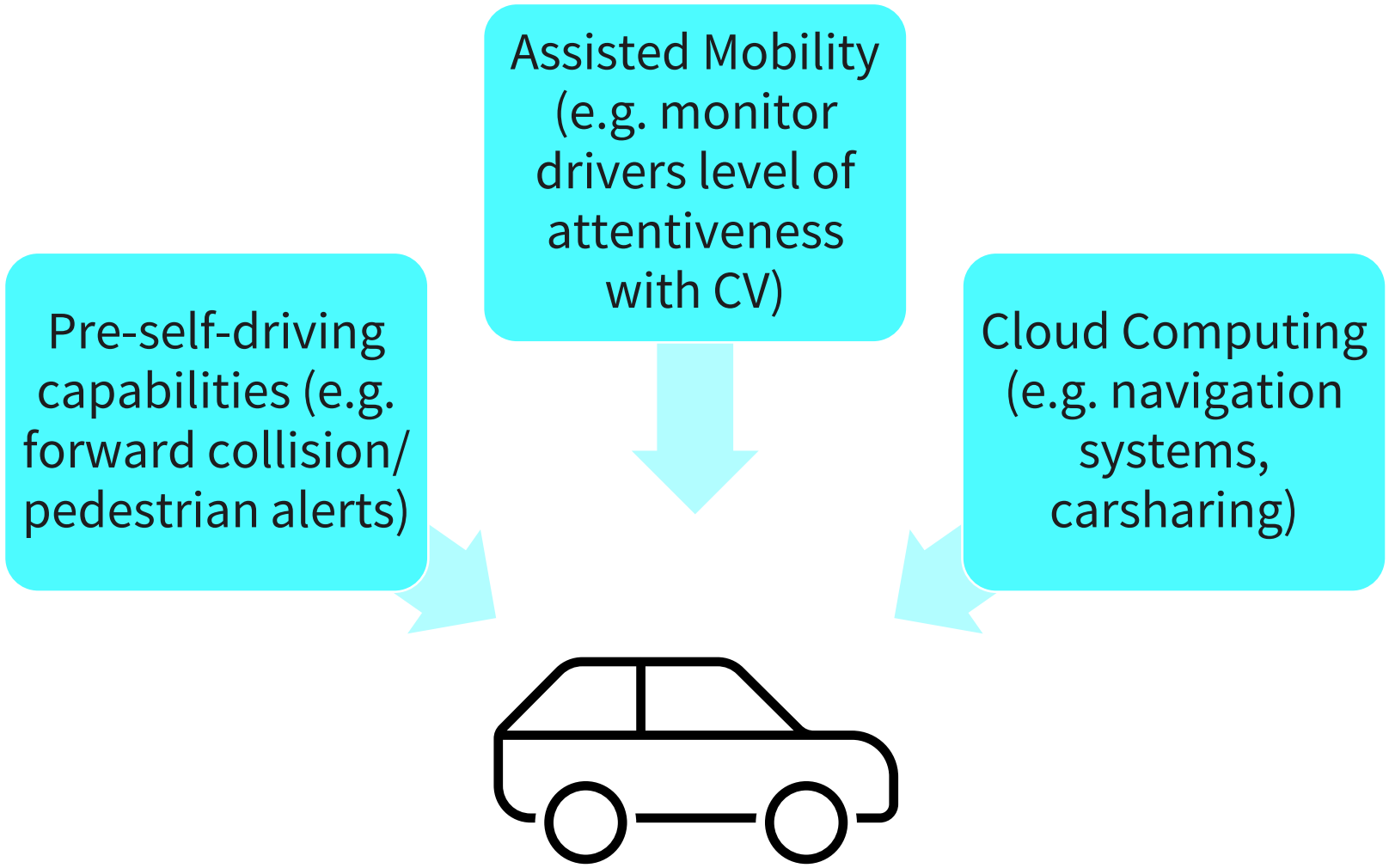
IMPORTANCE OF EXTENDED MOBILITY

- Fully automated vehicles can operate in a 24/7 mode
- Autonomous driving aims to reduce accidents and injuries, which will have a positive effect on hospital emergency room capacity needs and insurance rates

THE RELATIONSHIP BETWEEN ARTIFICIAL INTELLIGENCE AND AUTOMOBILES

- Artificial intelligence connects all different variables, e.g. , acceleration, breaking, and steering by employing radar, high resolution cameras, GPS, and cloud services, etc.
- Example: Tesla
  - Feature pre-self-driving capabilities, e.g., forward collision alerts, front pedestrian alerts, and automatic braking at a speed of <50 mph (80 km/h)

MOBILITY AND AUTONOMOUS VEHICLES



MOBILITY AND AUTONOMOUS VEHICLES

Source of the Video: YouTube, TED-Ed, 2019, https://www.youtube.com/watch?v=PRg5RNU_JLk.

Digital health management rests on four pillars:

- Early detection leads to prevention:
  - Oncoming ailment and prevent it from occurring altogether
  - Operate at nanoscale image level data points (AI & ML pattern recognition)
- Personalization rejects older medical paradigms that prescribed a general treatment regime for all patients diagnosed to have the same ailment
- Precision medicine considers the genetic make-up of an individual as well as their environment and lifestyle
  - Pattern recognition and ML augment medical judgement towards precision.
- Evidence-based vs experience-based approaches

Examples:

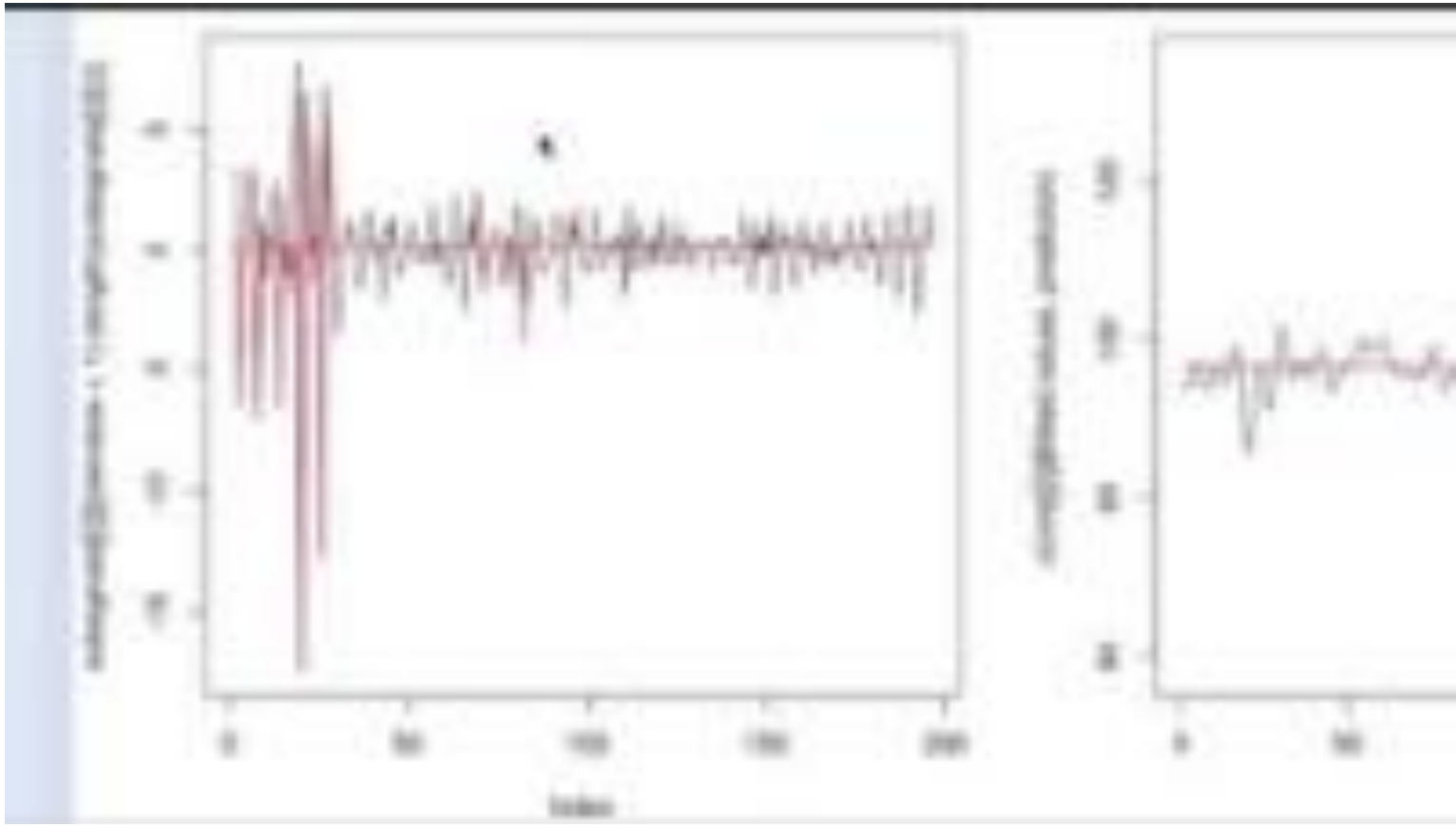
- Systems are used to detect skin diseases (in dermatology)
- In radiology, AI-based systems support medical personnel in analyzing and assessing computer-generated images
- Drugs are also becoming more personalized, and robotic surgery has a very good track record of saving lives

Sample List of Companies

- DeepMind: mining of medical records for scientific discovery and the development of treatment options for eye diseases (https://www.deepmind.com/)
- Verily: wearable sensors, glucose monitoring, and vision correction for the purposes of early disease detection (https://verily.com/)
- IBM Watson: building of models used for disease formation and development; visual recognition of emotions and empathy (https://www.ibm.com/watson)

Sentrian

Remote patient intelligence platform focusing on detecting outliers to flag health risks of individuals



Source of the Video: YouTube, Sentrian RPI, 2014, https://www.youtube.com/watch?v=G3aCkFKTwM8.

ADVANTAGES OF PRECISION MEDICINE

- Identification of treatment options that doctors and patients can jointly decide on
- Patient sensors, inexpensive genome sequencing, and a patient's digital medical history provide a vast data source for intelligent decision-making support
- AI contributes its reasoning abilities to the formulation of treatment options
  - IBM program called "Medical Sieve" uses a cognitive assistant to draw on a patient's personal medical data and unstructured clinical information, such as doctors' digital notes and radiology images, to deliver reasoned treatment options

ISSUES

- Medical errors are still unlikely to be eliminated
  - To what extent the treating physicians are liable for errors made by the AI system
  - To what extent non-medical personnel may use these systems and make decisions regarding the treatment of patients on this basis
- The use of precision medicine will no doubt give rise to new ethical issues to which society will have to respond.

FINTECH

- FinTech deals with business models and operations in the financial sector that involve computing and algorithms
- FinTech promises to bring about a revolution in the financial sector
- The FinTech promise is that so-called “brick and mortar” institutions can be replaced by electronics (money can be replaced by digital currencies to account for exchanged value)
- 5 FinTech product categories: ideas and financing via the crowd, blockchain, peer-to-peer payment systems, insurance and financial risks, and robo-advising.

- Crowdsourcing
  - The “crowd” as an aggregate has more ingenuity to generate solutions than the asking party alone
  - Innovation is often triggered by both needs and opportunities that arise within its circle of influence
- Internal-external innovation
  - Companies can certainly utilize their employees as a crowd-based source of innovative ideas
  - External crowds are formed by the public at large
    - The external crowd is far more diverse than the internal employee crowd and is more likely to come up with outlier proposals

- Crowdlending
  - Crowdlending is known as peer-to-peer lending in which crowds provide the funding for an investment project.
- Credit scoring
  - Traditional bank loans are approved and then granted on the basis of pledged assets by the borrower or justified by credit ratings based on previous transaction behavior.
  - With AI, on-traditional data sources can be leveraged to compute a credit score

- Blockchain
  - Digital, decentralized ledger that records all transactions in a peer-to-peer (P2P) network.
  - “digital”: electronic representation of data, “decentralized”: a database that is equally shared across the network.
  - P2P is a network architecture in which peers partition tasks without the need for a central server to manage the process.
- Cryptocurrency
  - Cryptocurrencies are currencies based on a ledger provided by blockchain technology.
  - The currency (Bitcoin, Ether, etc.) are created via encryption, which is where the name cryptocurrency comes from.
  - The encryption process is intended to make such currencies secure and transactions using these currencies difficult to fake or alter.

FINTECH PRODUCT: PEER-TO-PEER PAYMENT SYSTEMS (P2P)

- The goal is to allocate funding or split a transaction between two or more parties and their respective accounts, oftentimes all through a mobile device
  - Eg., sharing a meal among friends to buying goods and services.
- Start-up platform PayPal was established in 1998 with the intent to revolutionize the money transfer business, with eBay as its major client
- Fraud detection is a major concern with respect to the handling of money

FINTECH PRODUCT: INSURANCE

- The insurance industry is deeply affected by AI in the marketplace as well as the processes supporting insurance products, which are referred to as “insurtech”.
- Three trends are developing:
  - Internal car sensors can collect data relative to driver performance and behavioral risk. These metrics may support future assessments about healthy lifestyles and a driver’s capacity to drive. Consistently good metrics support lower insurance premiums as a result of fewer claims.
  - The insurance policy buying experience: employing chatbots with natural language processing capabilities. Chatbots can draw on rate schedules and answer conventional client inquiries. The theoretical result is a faster, more accurate, and less costly process.
  - Automatically settling claims with AI, quicker and at a lower cost
- AI and Internet of Things (IoT) technology can be used to personalize the insurance risk assessment process

FINTECH PRODUCT: ROBO-ADVISING

- Portfolio allocation management service used in the financial sector (without human intervention)
- The service appeared on the market during the 2008 financial crisis, with the term denoting algorithms that manage portfolio composition
- The algorithms are offered through broker-dealer platforms.
- Procedure:
  - An investor can start by defining their personal risk profile, their suitability in terms of age and financial situation, and then open a robo account.
  - Given a sum of funds deposited into an account, the algorithm will allocate these funds, typically bonds and fixed income securities, in order to continually reach the stated target
- Examples:
  - Intelligent Portfolio (Charles Schwab) (https://www.schwab.com/intelligent-portfolios)

Numerai: Hedge fond gathering different data sources and providing it to data scientists

Investment Process:

Research and Data	Numerai researches and combines a large number of data sources together and transforms the data into regularized features and targets to create a pure dataset for the data science community.
Data Tournament	Datasets are made available to our community of data scientists who compete to create the best predictive models in a tournament. Data scientists stake their best models with our cryptocurrency, NMR.
Meta Model	Numerai creates the Meta Model by combining the latest predictions from the tournaments and outputs a signal for each stock in our investable universe.
Portfolio Construction	Model is fed into Numerai's optimization engine to construct the optimal risk penalized, market neutral portfolio.

Source of the text: https://numer.ai/fund.

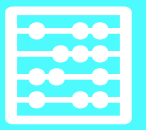
FINTECH PRODUCTS

Peer-to-Peer (P2P) Payment Systems

Split transactions between parties (e.g. PayPal)

Blockchain

digital, decentralized ledger that records transactions in a P2P network



Cryptocurrency

currency based on blockchain technology outside of centralized banking system with encryption (BitCoin)

Robo-Advising

Portfolio allocation management service offered through broker-dealer platforms

Retail sector has changed

- The buying experience is becoming ever more convenient for the consumer
- The retailer-customer dialogue is being digitalized in order to capture all details of a transaction
  - Massive amounts of data are collected that enable analytics
- Customer information is now being identified at the street number level
- The internet and, to some degree, artificial intelligence have shifted economic power in favor of the consumer

Customer behavior has also changed:

- Customers expect and receive instant access to all product offerings
- Customers expect personalized answers to their questions
  - Virtual assistants and natural language processing technologies.
- Customers demand next day delivery in many instances.
- Customers expect low prices, top quality, free delivery, and a clean, secure, and seamless transaction.

Customer-retailer relationship has changed:

- Technology-empowered customers shop with mobile devices, anytime, anywhere
- Customers are motivated by self-interest and have gained economic power
- Technology-empowered retailers adjust to equally empowered customers to meet their expectations in order to try to regain marketing control by new means.
- Retailers are motivated by survival in competition with other retailers
  - Providing better customer service is one way to survive
  - Retailers have less economic power than was historically the case when compared with consumer power.

Current retail paradigms:

1. Improvement of the flow of goods (demand forecasting)

2. Development of a better customer understanding (data analytics)

3. Improvement of customer buying experience (virtual assistants, recommendation engines, personalization)

4. Introduction of new technologies to support (virtual fittings)

AI USE CASES IN THE RETAIL SECTOR

Source of the image: PowerPoint Stock Images.

- Automating browsing experience (improved and personalized search engines)
- Omnichannel personalization to capture prior customer interaction (in-store and online)
- Optimization in retail operations (robotics, faster fulfillment, better demand forecasting)
- Gather detailed market knowledge to improve client interactions through campaigns and social media participation

- Omnichannel
  - Mobile devices, social media, online sales through web-enabled stores, etc.
  - Performing quantitative network analytics is a method for gaining insights relative to the system (with NLP and ML)
- Customer loyalty
  - Convince customers to repeatedly purchase from the retailer/brand
  - E.g., Rebates, coupons, free phone numbers, etc.
  - Machines may learn from customer purchasing behavior and the demographic data of loyal customers what actually makes them loyal

- Forecasting
  - Predict the future sales based on past sales
  - Predict the trend (fashion industry)
  - A well-established future forecasting process may include:
    - Examining all possible causal factors
    - Analyzing products in stock
    - Predicting the next period (applying neural nets and other machine learning algorithms)
    - Selecting the best models
    - Identifying growth factors
  - Predictive analytics

MISCELLANEOUS RETAIL TECHNOLOGIES

- Internet of Things (IoT) technology
  - Radio Frequency Identification (RFID) - inventory management & monitoring of product movement
- Warehouses: robots place and retrieve items
- Equipment failures in retail: forecasted by sensors
- Delivery robots
- Predict human behavior by facial recognition
- Visually check inventories and misplaced items by in-store robots

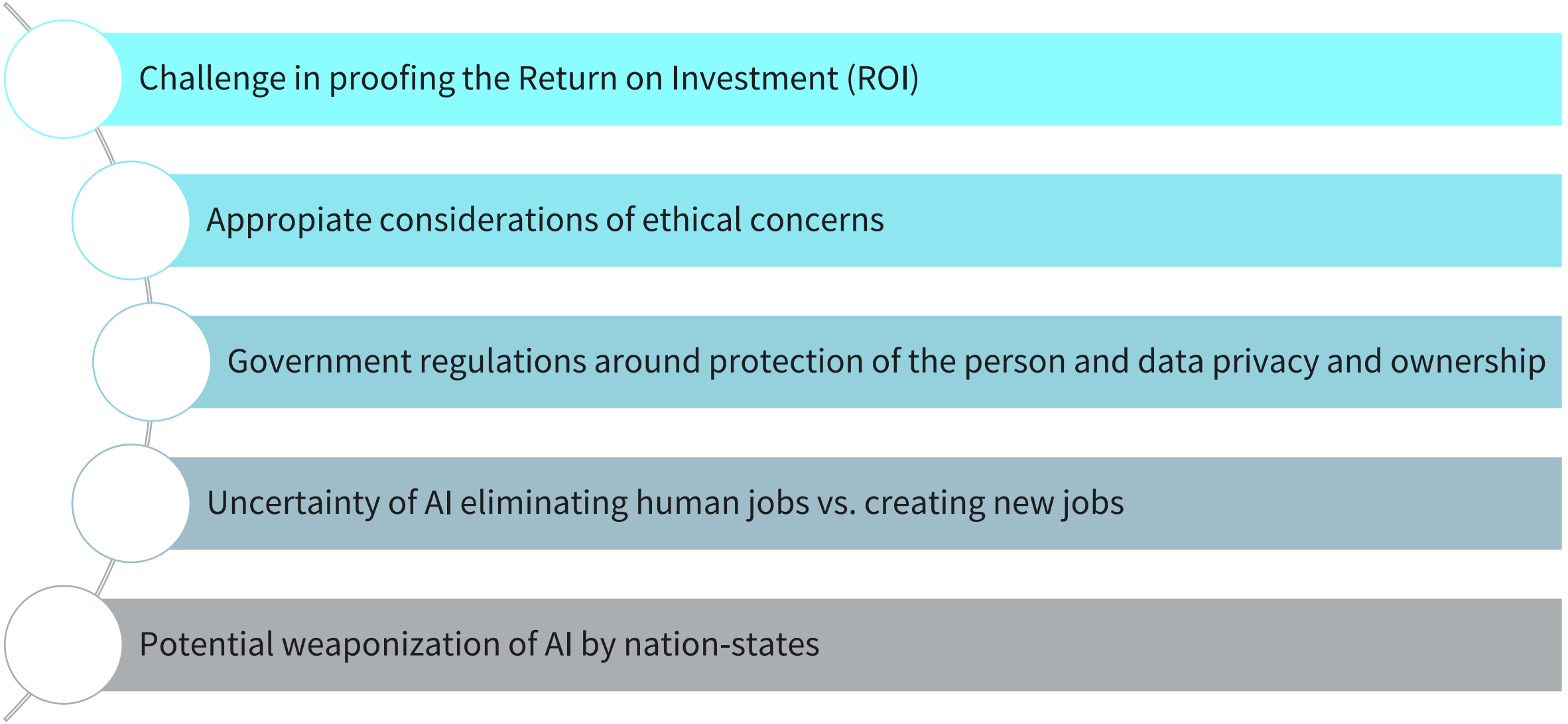
TRENDS OF AI IN THE RETAIL SECTOR

- Assistants and automated search engines endowed with NLP combined with data-driven analytic models
- The trend towards personalization will accelerate
- Retail operations will become a lot faster
- Retailers prefer to mold and influence their clients as much as possible

FURTHER ARTIFICIAL INTELLIGENCE APPLICATIONS

- Banking and finance
  - Fraud detection and cybersecurity concerns
- Energy and utility companies
  - Forecast energy demand
  - Identify the location of a power outage problem
- Education
  - Text analysis of student work
  - Adaptive courseware: adapt learning paths to the needs of students
- Retail and e-tail companies
  - Recommendation engines
  - Price expectation

CHALLENGES FOR FUTURE AI APPLICATIONS



AI APPLICATIONS AND THEIR MEASUREMENT CRITERIA

- Self-driving vehicles and trucks adhere better to traffic rules than humans do, have fewer accidents and incidents
- AI vision can identify and label what it sees
- NLP achieves accuracy in language translation and speed, etc.
- Machine learning provides explained decisions
- The future of robotics is still unknown
  - Will robotics replace human work or augment human work?
  - Will robots learn the correct things?, etc.

PROMISING DEVELOPMENTS IN THE FIELD OF ARTIFICIAL INTELLIGENCE

- Humanlike robots will become available for industry and entertainment
- Conversational marketing used for booking meetings and answering e-mails will be enhanced with chatbots and machine learning
- Advances in the discovery of drugs, diagnostics and treatment
- Robo-advising in the field of finance
- Crowdsourced hedge funds based on more than 35,000 data scientists are being used to predict the stock market
- Google smart maps help clients find the best routes
- Identify and remove bad actors from social media platforms
- …

REVIEW STUDY GOALS

You have learned …

- … how artificial intelligence techniques will aid the coming mobility revolution.
- … about the ways the medicine and health care sectors can benefit from artificial intelligence.
- … to distinguish between the multitude of ways artificial intelligence is used to support current financial processes as well as enable entirely new business models in the financial sector.
- … how artificial intelligence is employed in retail to automize workflows, optimize supply chains, and help in tailoring services to customers.

SESSION 6

TRANSFER TASK

TRANSFER TASK

Choose an AI-driven company of your choice and pitch it to your classmates. Explain the meaning of AI for the company – how might the company look like without AI?

Some ideas:

- Aurora
- DocuSign
- Big Techs: Airbnb, Amazon, Google, Meta, Microsoft etc.

TRANSFER TASK
PRESENTATION OF THE RESULTS

Please present your results.

The results will be discussed in plenary.

1. Robo-advising is a FinTech term that describes
   a) advice given to banks to choose between.
   b) industry advice on the purchasing of robots.
   c) advice on the best encryption schemes for blockchains.
   d) automatic portfolio allocation and management.

2. Government regulation of artificial intelligence is
   a) not at all advisable.
   b) limited to the application of artificial intelligence in warfare.
   c) only advisable with respect to potential job market impacts.
   d) advisable with respect to the protection of privacy and rights to data ownership.

3. One major customer facing artificial intelligence service in retail is given by
   a) customer support chatbots.
   b) supply chain optimization.
   c) automatically controlled warehouses.
   d) call center management.

How did you like the course?