CMP-6040A/7028A

University of East Anglia

ARTIFICIAL INTELLIGENCE

Introduction to AI and AI Modules

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Teaching Team:

Lecturers:

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Assistants:

4. Dr. Geoffrey Guile
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Aim and key changes

- Aim: to learn basic concepts and modern methods in artificial intelligence

- The module is redesigned over the summer.

- Key differences
  1. About 60% of the contents are new
  2. Use Python(3), instead of Prolog
  3. Coursework(CW) will be radically different
  4. Mark weights for CW and Exam will be changed

Main contents(Red = New)

1. State Space Search Methods
2. Game playing theory and methods
3. Path Planning
4. Intelligent Agents
5. Bayesian theory and belief network
6. Markov Models and Decision Process
7. Expert System and Chat Bot
8. Neural networks
9. Deep learning
10. Robotics and UAV(Drone)

Any Questions and Comments?

Reference Reading

1. "Artificial Intelligence: A Modern Approach” 3rd edition.

   Stuart Russell & Peter Norvig
   Some copies available in the Library

2. "Artificial Intelligence: Structures and Strategies for Complex Problem Solving“

   George Luger, 6th Edition.
   Some copies of 5th edition available in the Library

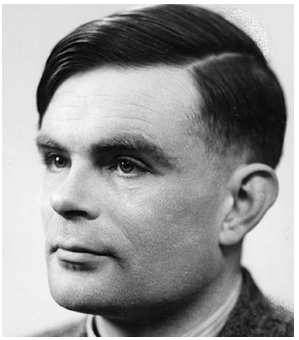
Lectures and Labs

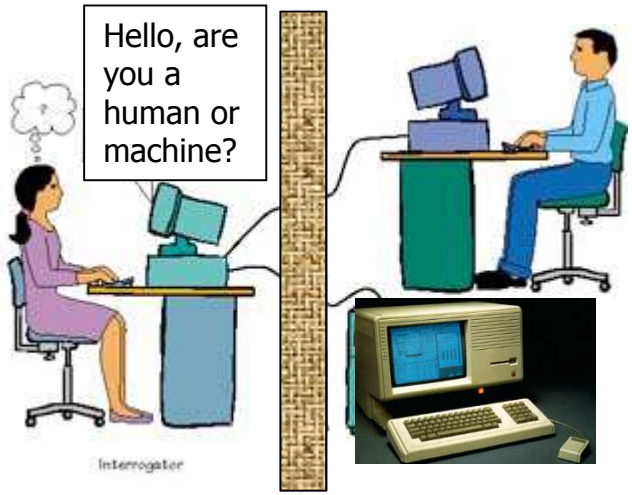
- Teaching from Tuesday of Week 2
  - Lecture on Tuesday 0900-1100 at SCI 3.05
  - Seminar/Labs at MSc & Graphics Labs
    - Weeks 2 and 3:
      - Tuesday 11-13 at BIO 0.12: All together
        Seminar on Python. Take your laptop if you have.
      - Wednesday 11-13: Labs on Python
        - 6040A at PC Labs 3&4,
        - 7028A at S2.28
    - Week 4 - 11: (groups will be decided later)
      - Tuesday 11-13: Normal AI Labs for Group 1 at BIO 0.12
      - Wednesday 11-13: AI labs for Group 2, S2.28

What is AI?

- What is Artificial Intelligence?
  - Two Short AI Intro-Video
    - AI short Introduction(BBC) (117s)
    - AI video(101s)
  - A computer system/device that attempts to mimic human behaviour in terms of using human intelligence to deal with real world problems.
  - It involves
    - Learning: knowledge acquisition
    - Problem solving: apply the learned knowledge to solve real world problems.

Alan Turing Test





Human

Computer:
AI System

- In 1950, Turing*
  - Predicted that by 2000, a machine might have a 30% chance of fooling a lay person for 5 minutes.
  - Anticipated all major arguments against AI in following 50 years
  - Suggested major components of AI: knowledge, reasoning, language understanding, learning
- Problem: Turing test is not reproducible, constructive or amenable to mathematical analysis.

*Reference: Alan Turing. “Computing machinery and Intelligence.“ _Mind_, 59 (1950), 433-460.

Brief History of AI

- 1940-1950: Early days
  - 1943: McCulloch & Pitts: Boolean circuit model of brain
  - **1950: Turing's "Computing Machinery and Intelligence"**
- 1950-70: Excitement: Look, Ma, no hands!
  - 1950s: Early AI programs, including Samuel's checkers program, Newell & Simon's Logic Theorist, Gelernter's Geometry Engine
  - 1956: Dartmouth meeting: "Artificial Intelligence" adopted
  - 1965: Robinson's complete algorithm for logical reasoning
- 1970-90: Knowledge-based approaches
  - 1969—79: Early development of knowledge-based systems
  - 1980—88: Expert systems industry booms
  - 1988—93: Expert systems industry busts: "AI Winter"
- 1990-: Statistical approaches
  - General increase in technical depth
  - 1997: Deep Blue- the first AI chess-playing system to beat a reigning world chess champion, Garry Kasparov
- 2000-: Data mining and machine learning developed rapidly
  - Increasing computational power
  - **2016: AlphaGo beat a world champion of the Chinese board game Go**

AI and Natural Languages

- Knowledge Representation
  - Representing knowledge in some ways that a machine can use for problem solving/

- Natural Language Processing/Understanding
  - Automatic speech recognition (ASR)
  - Text documents analysis
  - Text-to-speech synthesis (TTS)
  - Dialog systems: questions understanding and answering- chat bot
  - Machine translation

AI & Perception: Sound & Vision

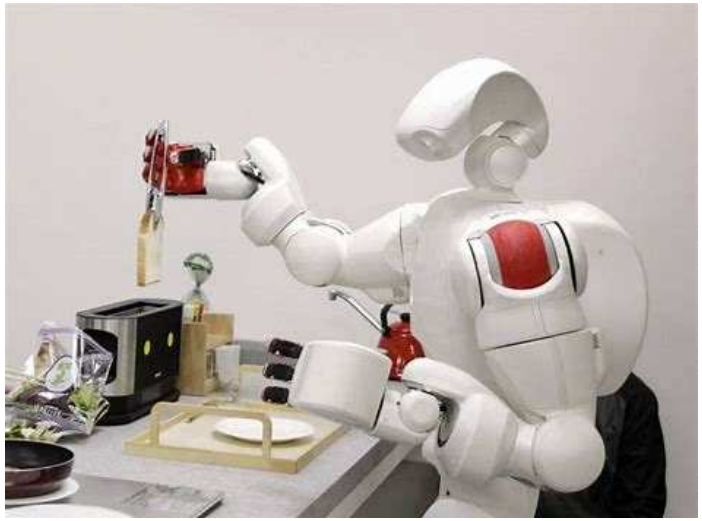
- Perception: getting the surrounding information with various sensors:
  - Sound sensors, e.g. microphone, sonar,
  - Image/Vision sensors: camera, radar
  - Force, Pressure sensors
  - Many others
- Processing multimedia information
  - Object and face recognition
  - Scene segmentation
  - Image classification

Robots

- Robot: A machine that resembles a living creature in being capable of moving independently (as by walking or rolling on wheels) and performing complex actions automatically.
  - Can be controlled by an external or embedded controller
  - Or can be autonomous or semi-autonomous

- There are many different kinds of robots
  - Industrial robots
  - Medical robots
  - Domestic robots
  - Military robots
  - Mobile robots,
  - Unmanned aviation vehicle(UAV), e.g. Drone
  - Animal robots

Industrial and Domestic Robots

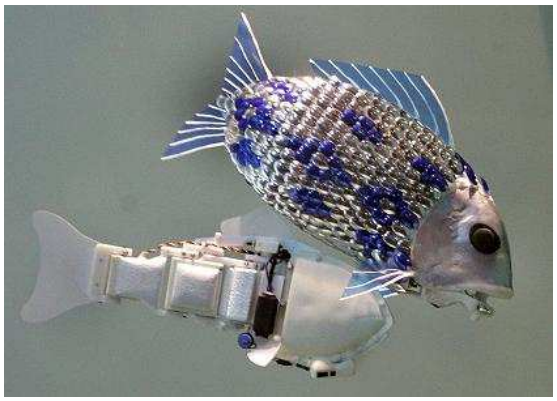


Medical Robots

- Medical robots

Animal Robots

- Various Animal Robots:



- Robot dogs learn to open a door(44s)

Unmanned Aerial Vehicle(UAV)

- An unmanned aerial vehicle(UAV) is an aircraft or called a drone, that is not piloted by a human on board but by a computer or remote controller.

CMP student made one

Sophia – A Humanoid Robot

Sophia is a social humanoid robot

- Developed by Hong Kong-based company Hanson Robotics.
- Was activated on April 19, 2015
- Able to display more than 50 facial expressions.
- October 2017, became the world 1st robot citizen
- Covered and interviewed by world major medias
- Interviewed by a BBC journalist - Michael

Chat Bots

As AI technologies and
Computing Power
have been rapidly
advanced in the last decades,
Alan Turing Test has been
evolved to more powerful
specialised expert systems,
e.g. Chatbots
Here are some conversational Chatbots

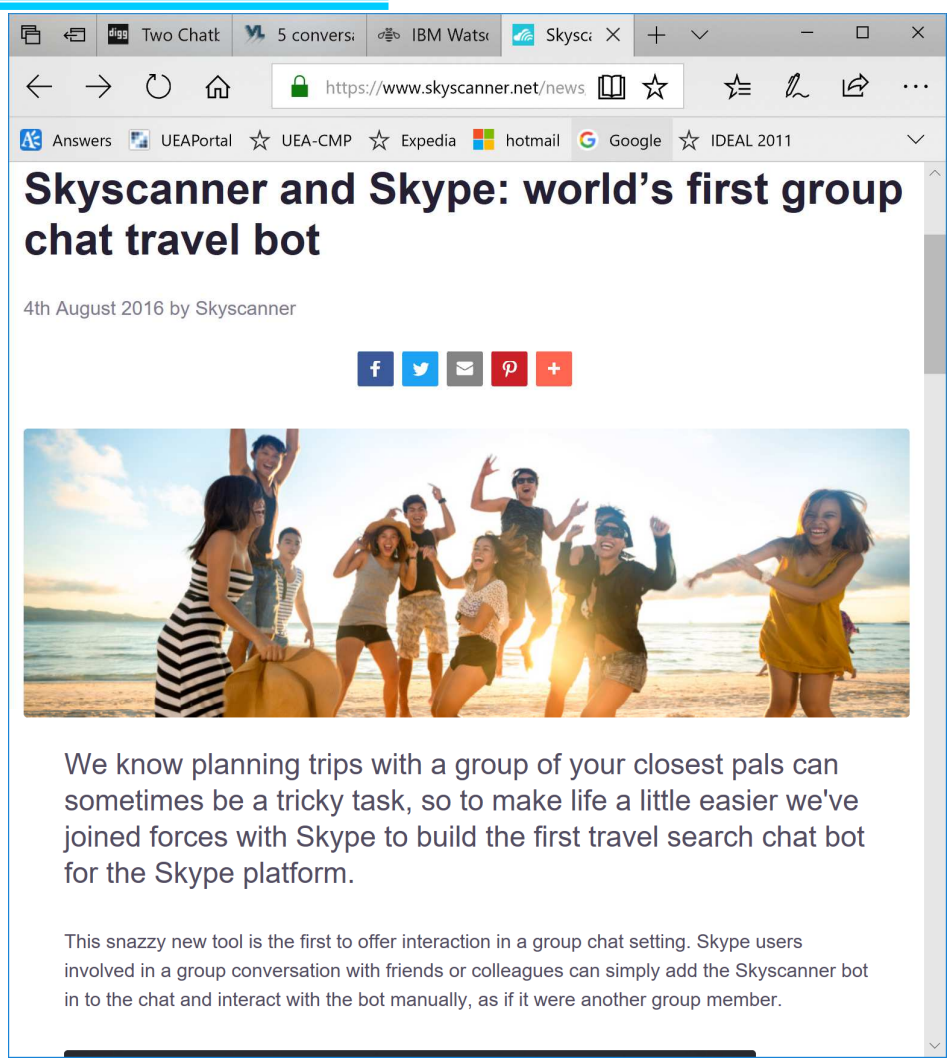
- A travel booking Chatbot
- Two bots chat each other.
- An example of meaningless bot chat

Chat Bots

- An example of Expert Systems is Chatbot
- Many have been developed.

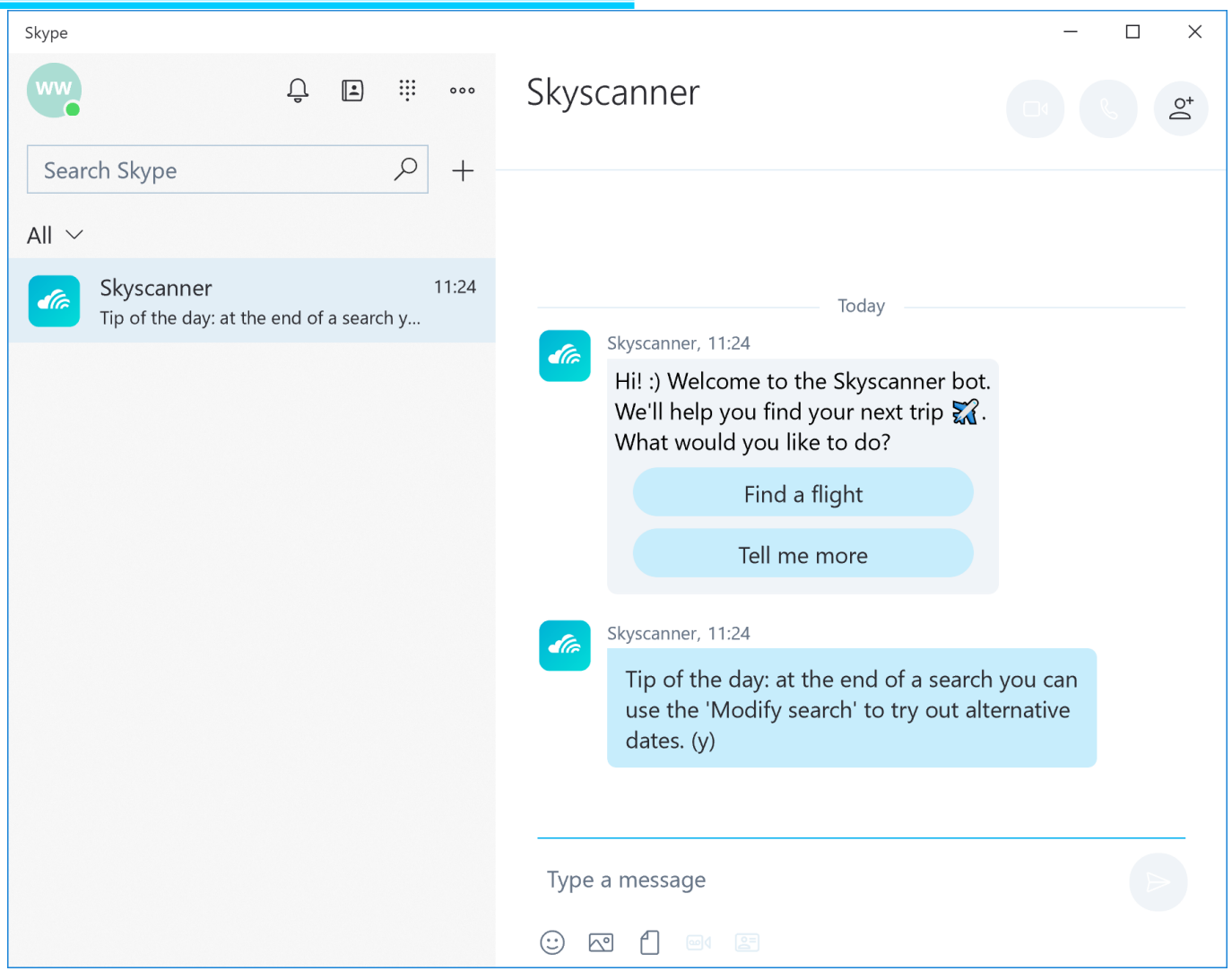
e.g.

- Skyscanner Chatbot



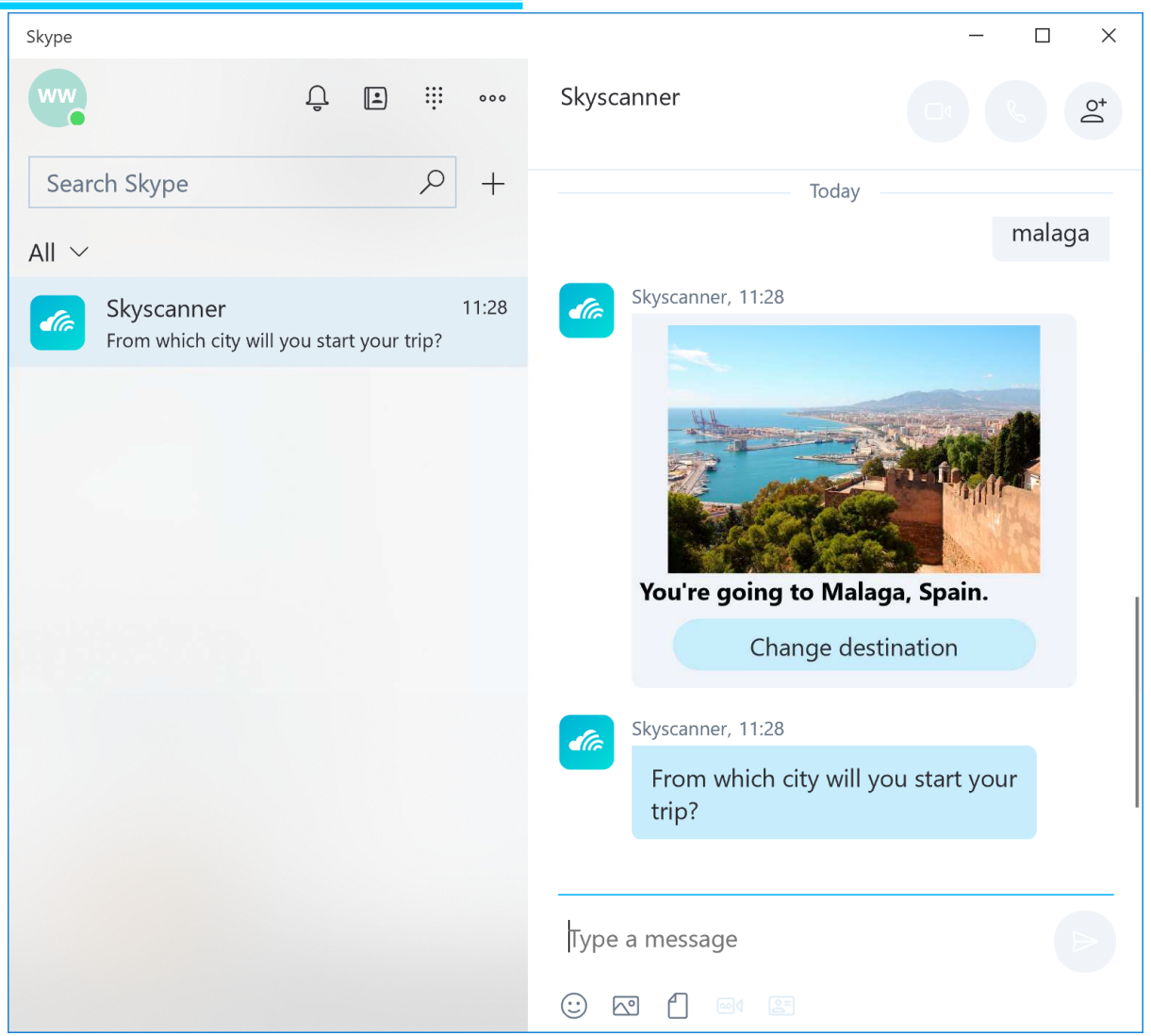
Skyscanner Chatbot

- I played with it a bit.
- It starts from Skype.



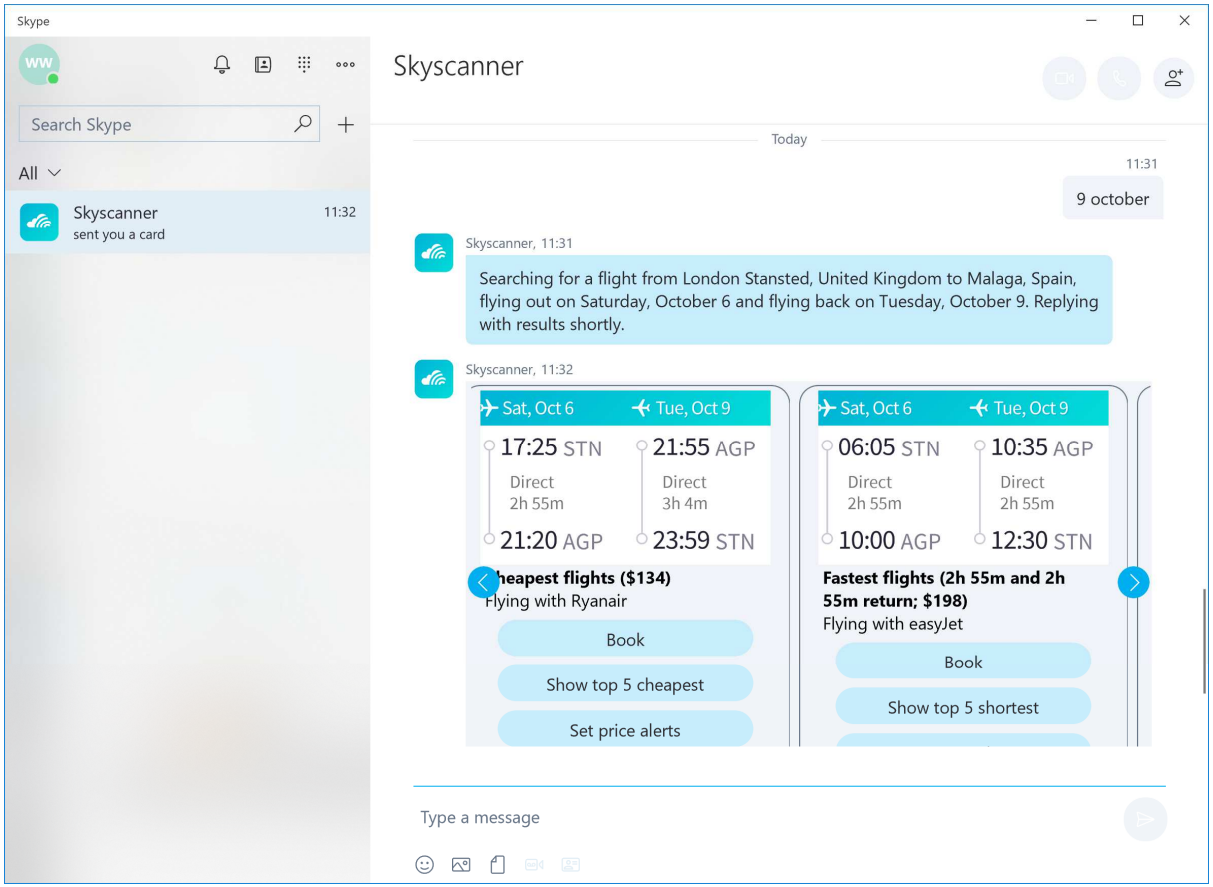
Skyscanner chatbot

- It asked me where I want do go.
- I answered: Malaga
- It confirmed back my destination, with a picture of Malaga
- Then asked me from where I start my trip.



Skyscanner chatbot

- It then accessed the flight ticket search engine Skyscanner with the necessary information gathered through the dialogues.
- Got the results from it and presented them on its interface.
- When I clicked a specific flight, it directed me to Skyscanner's ticket booking web site.



Assessments

- Assessments:
  1. One coursework(CW) assignment
  2. Exam
- Current Weights: CW 40% and Exam 60%
  Discussion: proposed to change to 50%:50%
- Coursework Assignment:
  - Set in Week 4
  - Tasks: ? (have some ideas but undecided yet, need discussion)
  - Deadline: Week 12,
    Demo on Tuesday, Report on Wednesday, 3PM
- Exam between late May and Early June
  - Section A: compulsory questions
  - Section B: Choose some out of some questions
- A revision session could be arranged in time if requested.

Coursework: Idea for Discussion

- Basic task: Developing an intelligent chat bot
- Topics of chat, e.g.
  1. Find a cheapest train ticket from A to B on a given date and time interval.
  2. Maybe others.

  The topic will be decided and the specification will be set later.
- Format: grouped mini project
  - A group is composed of 3 students.
  - Three ways to form a group:
    - You do yourself
    - Assigned by me
    - Allocated at random

Coursework: Assessments

- Basic task: Developing an intelligent chat bot
- Development Platforms and Languages:
  - you choose them and justify your decisions.
  - Or Specified by me.

- Assessments:
  - Group demo in Week 12
    - Demonstrate your chat bot in real time
    - Make a video of 2-3 minutes
  - Group and individual reports