MAI4CAREU

Master programmes in Artificial Intelligence 4 Careers in Europe

University of Cyprus

MAI613: Research Methodologies and Professional Practices in AI

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Fall Semester 2022-23

Co-financed by the European Union
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Introductions

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Course Objectives

- Introduce students to the methods and tools of Artificial Intelligence research, professional practices, and associated technological culture, bearing in mind EC's regulatory framework.
- Familiarization with reading academic papers
- Familiarization with reviewing and presenting of relevant literature
- Familiarization of technical writing and literature surveying

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Course Content

- Introduction to the academic research methods and practices
  - Introduction to research and main AI research areas (Week 1)
  - Practical issues of writing academic papers (Week 2)
  - How to give a good talk (Week 4)
  - Introduction to European Commission's regulatory framework for the development of secure, trustworthy and ethical AI. (Week 5)
- 5-6 Seminars from invited researchers/industrialists/entrepreneurs pursuing research/applications in AI (Week 2, 6 – 10)
- Literature review paper. Group presentations of technical study (Week 11 – 13)

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Bibliography

- Course's power point slides
- Academic papers
- Course's website

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Course Evaluation

- Attendance of the introductory lectures, seminars and final group presentations
- Short summary for one of the invited speakers' seminars (1- 1.5 pages)
  - Research idea
  - Methodology
  - Discussion of results and conclusions

- Group report and presentation of critical review of academic papers on a chosen topic on a particular AI research area.
  - Groups will consist of 2-3 persons
  - Teams will be formed by the course's instructor after completing a Google form
  - Each group should decide a specific research topic, review relevant academic papers and prepare a literature review report (survey) including a critical discussion.

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Course Evaluation

Group Literature Review Assignment

- Literature review report (State-of-the-art summary and discussion)
  - Article length: @ 10-15 double-spaced pages in a 12-point font
  - The group should search and collect ~30 related articles on their topic
  - Prepare a report to summarize the main findings of these articles to describe the “start of the art” concerning your topic.
  - The report can be written either in Latex or Word. Examples of templates will be uploaded in Moodle.
- Peer-review of draft reports
  - Each student will be allocated one report to pee-review
  - The final report will be submitted on 01/12 along with the responses to the reviews.
- Group presentation
  - The reports will be presented on Week 11 -13 (16/11, 23/11, 30/11)
  - 25 minutes presentation, ~10 minutes questions/discussion

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Course Evaluation

- Attendance 5%
- Individual reports - Summary of one seminar – 15%
- Group research report – Part B, C, F – 40%
  - Individual peer-review – Part D – 20%
  - Group presentation (Part E) – 20%

- Final grade of the course: Pass (>=5/10) /Fail (<5/10)

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Introduction to the course

Research Seminars

- Research seminars related to AI topics from invited speakers from universities in Cyprus, research centres or from industry.
- Each seminar will present a research problem/question in a research topic relevant to AI based on the speaker's research interests.
- The speaker will present their methodology and analysis of solving this problem/answering the question and their results or even any products coming out.
- Some seminars will be based on a single research paper and some others will be more general (but not too technical).
- The research papers will be uploaded in the Moodle before the talk.

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Introduction to Research

- Research is not:
  - Information gathering:
    - Gathering information from resources such books or magazines isn't research.
    - No contribution to new knowledge.
  - Transportation of facts:
    - Transporting facts from one resource to another doesn't constitute research.
    - No contribution to new knowledge although this might make existing knowledge more accessible.

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Introduction to Research

- Research is:

> "…the systematic process of collecting and analyzing information (data) in order to increase our understanding of the phenomenon about which we are concerned or interested."

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Types of Research

- Theoretical
  - It involves the proposition of new theoretical notions, axioms, lemmas, or methods that reside on a higher level of abstraction and generality (theoretical computer science)
- Applied
  - It targets the practical field of research by applying the theory on existing industry problems (e.g. medical informatics – telemedicine)

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Research Characteristics

- Research begins with a question in the mind of the researcher
- Requires a plan
- Demands a clear statement of the problem
- Guided by specific problem, question, or hypothesis
- Accepts certain critical assumptions
- Requires collection and interpretation of data
- It is circular

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Research Projects

- Research begins with a problem
- This problem need not be Earth-shaking
- Identifying this problem can be the hardest part of research
- In general, good research projects should:
  - Address an important question
  - Advance knowledge

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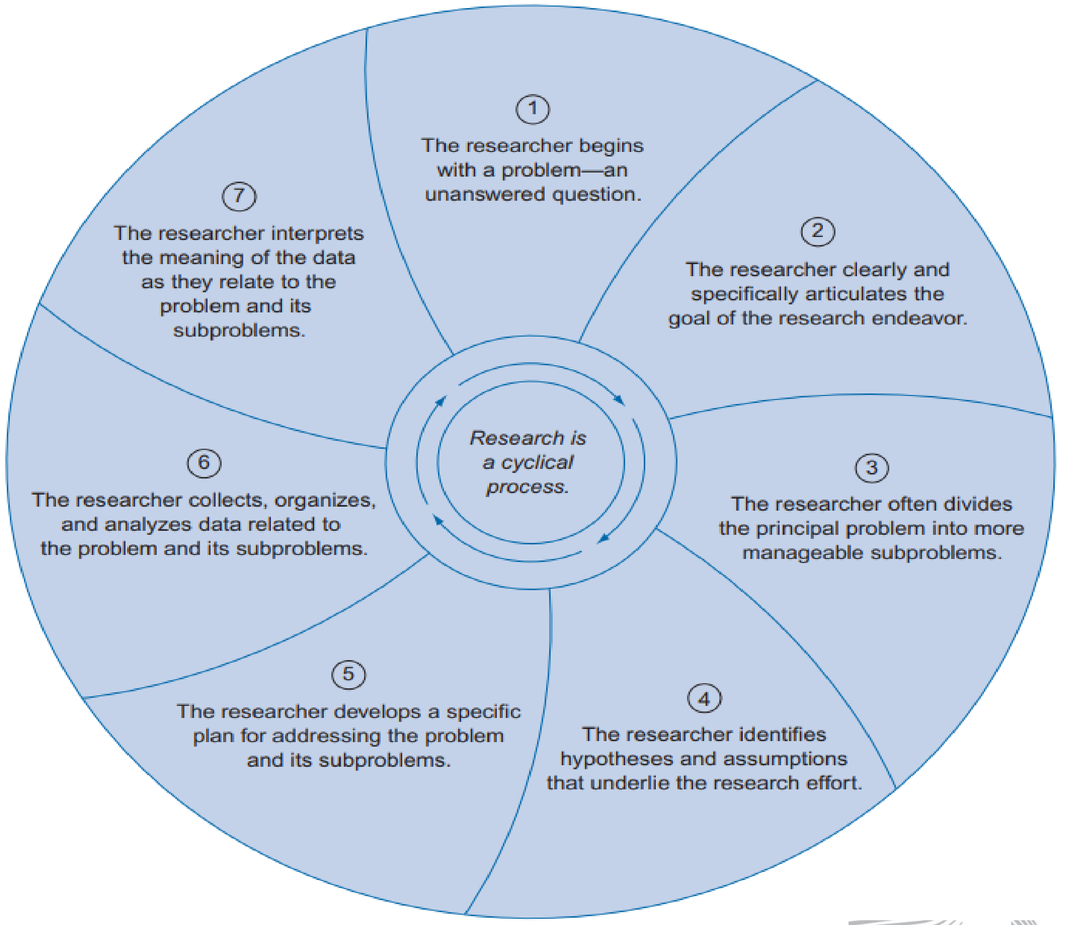
Research Cycle

- In general, research involves seven distinct steps, as shown in the next figure.



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Introduction to Research

Sources of Research Problems

- Observation.
- Literature reviews.
- Professional conferences/journals.
- Experts.

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Stating the Research Problem

- Once you've identified a research problem:
  - State that problem clearly and completely.
  - Determine the feasibility of the research.
- Identify subproblems:
  - Completely researchable units.
  - Small in number.
  - Add up to the total problem.
  - Must be clearly tied to the interpretation of the data.

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Introduction to Research

Research Skills

- Critical thinking
- Literature searching, summarizing
- Critical reading, evaluation of relevance and value
- Identification of research question and hypotheses
- Recognizing similarities and differences
- Presenting logical and coherent outcome
- Presentation skills – both written and verbal

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Introduction to Research

Literature Review

- Summary and comparative analysis of state of the art related to the research problem
- A literature review is a necessity.
  - Without this step, you won't know if your problem has been solved or what related research is already underway.
- When performing the review:
  - Start searching professional journals.
  - Begin with the most recent articles you can find.
  - Keep track of relevant articles in a bibliography.
  - Don't be discouraged if work on the topic is already underway.

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Introduction to Research

Literature Review Pitfalls

- Be very careful to check your sources when doing your literature review.
- Many trade magazines are not peer reviewed.
  - Professional conferences and journals often have each article reviewed by multiple people before it is even recommended for publication.
  - The IEEE and ACM digital libraries are good places to start looking for legitimate research.

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Introduction to Research

Literature Review Pitfalls

- The Internet can be a good source of information. It is also full of pseudo-science and poor research.
- Make sure you verify the claims of any documentation that has not been peer reviewed by other professionals in the computing industry.

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Introduction to Research

Types of Methodologies

- Methodologies are high-level approaches to conducting research.
- The individual steps within the methodology might vary based on the research being performed.
- Two commonly used research methodologies:
  - Quantitative
  - Qualitative

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Methodologies Comparison

Quantitative

- Explanation, prediction
- Test theories
- Known variables
- Large sample
- Standardized instruments
- Deductive

Qualitative

- Explanation, description
- Build theories
- Unknown variables
- Small sample
- Observations, interviews
- Inductive

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Research in AI

What is AI?

- “Any set of computer programs able to mimic or even surpass human intelligence”, *Karim Lekadir*
- Systems learning from data
  - Big data
  - Machine learning methods
  - Self-learning

- “AI should be a tool for people and be a force for good in society with the ultimate aim of increasing human well-being”, *European Commission (COM (2021) 206 final)*

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Research in AI

AI Techniques

- **Machine learning approaches**, including supervised, unsupervised and reinforcement learning, using a wide variety of methods including deep learning;
- **Logic- and knowledge-based approaches**, including knowledge representation, inductive (logic) programming, knowledge bases, inference and deductive engines, (symbolic) reasoning and expert systems; and
- **Statistical approaches**, Bayesian estimation, search and optimization methods

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AI High-Risk Applications

- Biometric identification and categorization of natural persons
- Management and operation of critical infrastructure
- Education and vocational training
- Employment, workers' management and access to self-employment
- Access to and enjoyment of essential private services and public services and benefits
- Migration, asylum and border control management
- Law enforcement, and
- Administration of justice and democratic processes

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AI Research Areas

- Natural Language Processing
- Computer Vision
- Recommender Systems
- Artificial Intelligence of Things
- Secure, trustworthy and ethical AI
- Evolutionary AI
- Robotics AI
- AI in specific application domains i.e. medicine, education, banking

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AI Research Areas

Machine Learning

- Learning by data models
  - Supervised learning
  - Non-supervised learning
- Traditional ML models vs Deep learning models

- Classification (binary vs multi-label classification) or clustering

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AI Research Areas

Natural Language Processing (NLP)

- Techniques for processing natural language
- Text-to-speech recognition
- Speech-to-text
- Sentiment analysis – emotion detection from text
- Examples:
  - Chatbots
  - Voice assistants
  - Google translate

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AI Research Areas

Computer Vision

- Another popular AI application
- Connected to face recognition and biometric identification applications
- In general, it is the area that concerns image analysis and processing
- Examples:
  - Biometric identification applications
  - Smart car parking
  - Emotion detection through faces

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Research in AI

Recommender Systems

- Use of big data to provide personalized recommendations to the users
- Data can be collected from social networks, search engines, user ratings etc
- Examples:
  - Netflix
  - Amazon

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Research in AI

Artificial Intelligence of Things

- Internet of Things (IoT): Physical objects with sensors that connect and exchange data with other devices and systems over the internet or other communications networks.
- Artificial Intelligence with Internet of Things (AIoT): Combination of AI technologies with IoT infrastructure to improve human-machine interaction.
- Use of combination of computer vision, natural language processing, machine learning and other technologies.
- Examples:
  - Smart home
  - Smart cities

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Research in AI

Ethical AI

- Discrimination, bias in AI systems
- Transparency and accountability in AI systems
  - Can be achieved through Explainability AI
  - Auditing the systems

- More on this will be discussed on Week 4

Tay the racist chatbot Microsoft released Tay, an AI bot that learnt to chat by analysing and engaging in conversations with humans on Twitter Within 24 hours, Tay spoke like an angry, confused, racist misogynist. In a way, Tay is a collective failure because it acquired its unpleasantness from how humans tend to interact online. ML algorithms learn the structural biases and inequalities in our societies and find novel ways of discriminating against those that are already most affected by them.

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Research in AI

Main Steps

- Research question
- Motivation/Goals - Hypothesis
- Data collection
  - Social media
  - Crowdsourcing
  - Data banks i.e. e-health records, cloud computing
  - Wearable devices
  - Publicly available datasets
  - Surveys

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Research in AI

Main Steps (2)

- Data analysis
  - Statistical analysis
  - Build ML models for classification/clustering
  - Transparency of ML systems
- Evaluation of the methodology (AI system)
  - Evaluation metrics
  - Comparison of different models
  - Evaluated by experts (expert systems)
  - Usability evaluation
  - Ethical validation
- Interpretation of the results

Human Judgement (Human-centric AI)
Decision making

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Research in AI

References

- Leedy P. D. and Ormrod J. E., Practical Research: Planning and Design, 7th Edition. 2001.

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Lecture 1: Technical Writing

Learning Outcomes

- MSc thesis
  - Choosing your topic
  - Writing tips
  - Meeting with advisor
- Literature review
- Tips for writing scientific paper
  - Research question
  - Communication skills
  - Structure of the paper

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Lecture 1: Technical Writing

Academic (scientific) papers

- MSc/PhD thesis
- Conference/Journal paper
- Literature review paper

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Lecture 1: Technical Writing

MSc/PhD Thesis

- MSc thesis is shorter than PhD thesis and should have more specific goals
- A thesis submitted for a MSc must show evidence of independent enquiry and/or originality in either conclusions or method
- A doctoral thesis …… and must make an appreciable new contribution to knowledge in candidate's field.

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Lecture 1: Technical Writing

Originality of an MSc Project

- You do not have to develop a grand unified theory
  - Extending, testing or applying something already in the research domain
  - Develop a small part of a major new system
  - An incremental development, adding a little to our understanding of an area
  - A large worked example or case study

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Originality of an MSc Project

- “first-class” researchers work on
  - important problems (Hamming)
- Importance in highly subjective, but:
  - fundamental/central
  - difficult/challenging
  - likely to have many applications and impact on other fields
- but do not underestimate your research
  - you must believe that you are making significant contributions to an important problem

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Lecture 1: Technical Writing

Choosing a Topic

- Extremely important decision
- Can it be enthusiastically pursued?
- Can interest be sustained by it?
- Is the problem solvable?
- Is it worth doing? Is it manageable in size?
- Will it lead to other research problems?
- Is it compatible with your career plans?
- What is the potential for making an original contribution to the literature in the field?

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Choosing a Topic (2)

- If the problem is solved, will the results be reviewed well by scholars in your field?
- Are you, or will you become, competent to solve it?
- By solving it, will you have demonstrated independent skills in your discipline?
- Will the necessary research prepare you in an area of demand or promise for the future?

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You and your advisor

- The right relationship with your advisor is critical
- What you should expect:
  - Reasonable availability
  - Guidance on the topic and doing research
  - Encouragement
  - Listening and responding
  - Feedback on progress

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Lecture 1: Technical Writing

You and your advisor

- What your advisor should expect from you
  - Attendance at meeting
  - Reasonable independence and own management
  - Listening and acting
  - Regular evidence of progress
- Discuss
  - How much independence/guidance you need
  - How often you are going to meet
  - What sort of preparation is expected
- Talk with your advisor

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Lecture 1: Technical Writing

Literature review

- An integrated, organized overview of significant literature published in a topic
- Guided by research objective
- Involves:
  - Information gathering: scan, read, record
  - Critical appraisal: discover the precise contribution and detect bias, flaws, limitations
  - Coherent writing: find framework/structure and present in a clear, logical way

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Writing a review article – Why?

- Encourages you to critically evaluate the strengths and weaknesses of the related literature to extract the most pertinent information.
- The way you explore the related research papers, it will inspire you for your own work.
- Highlights your in-depth knowledge of a research area in order to be able give your own perspectives on recent advances and the future trajectory of a particular research question.

Dhillon, Paraminder. "How to write a good scientific review article." *The FEBS Journal* 289.13 (2022): 3592-3602.

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Lecture 1: Technical Writing

Tips on planning and writing a review article

- Before to start writing, draw up an outline of the text and graphics.
- It might take a few months to get to the stage of having a complete first draft for submission.
- You should work backwards from your deadline to ensure that you're allowing plenty of time for planning the review article and researching the topic, as well as for writing and editing the article.
- Think of a topic that you feel qualified enough to discuss in depth.
- Search if you can find at least 15–20 research papers relevant to the topic, published within the last 5 years.

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Where to start

- Find a good handbook, survey paper, Ph.D/MSc thesis
- Write down list of search terms, e.g. keywords, phrases, synonyms, names, etc.
- Use search tools
  - Google scholar, UCY library, specific journals
  - Paper quality (citations, impact factor of journals, author's reputation, etc.)
  - Look at the references and citations of good-quality relevant papers

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State of the art (Places to look)

- scholar.google.com (keywords, authors, citations)
- UCY library: 18,000 e-journal
  - http://library.ucy.ac.cy
  - https://library.ucy.ac.cy/subject_portals/computer-science/?lang=en (databases relevant to computer science)
  - http://ucy.cypruslibraries.ac.cy/search*gre~S2 (library catalog)
  - https://library.ucy.ac.cy/sources/doctoral-dissertations/?lang=en (doctoral dissertations)
- Many useful databases (incl. Web of Science, PubMed, Scopus, ScienceDirect)

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Examples of search engines and databases for scientific references and preprints

PubMed	https://pubmed.ncbi.nlm.nih.gov/	A free search engine that mainly accesses the MEDLINE database of references and abstracts in biomedical and life sciences. Maintained by the U.S. National Institutes of Health's National Library of Medicine (NIH/NLM). Distinct from PubMed Central, which is a repository of open-access full-text scholarly articles.
Google Scholar	https://scholar.google.com/	A free search engine that indexes the full text or metadata of scholarly literature, including peer-reviewed online academic journals and books, conference papers, theses and dissertations, preprints and more. Owned by Google.
Web of Science (WoS)	https://www.webofknowledge.com/	A paid-access platform that gives access to multiple databases hosting reference and citation data from academic journals and conference proceedings across multiple disciplines. Owned by Clarivate.
Scopus	https://www.scopus.com/	A paid-access abstract and citation database covering titles—mainly peer-reviewed journals—from a large number of publishers within the life, social, physical and health sciences. Owned by Elsevier.
CORE (Connecting Repositories)	https://core.ac.uk/	An aggregator of open-access content from different systems. All content can be accessed and downloaded free of cost and has limited reuse restrictions. Provided by the Knowledge Media Institute based at the Open University, UK.
Europe PMC	http://europepmc.org/	A free repository of open-access full-text biomedical and life sciences research articles. Includes citation information and text-mining tools that link to external molecular and medical databases. The content mirrors that of PubMed Central. Europe PMC is managed by the European Molecular Biology Laboratory-European Bioinformatics Institute (EMBL-EBI).
Science.gov	https://science.gov/	A free, specialised search engine that provides access to the United States government science and technical information and research. Owned by the US government.
bioRxiv	https://www.biorxiv.org	A freely available repository of preprints (papers that have not been peer-reviewed and have undergone only basic checks) within the biological sciences. Its sister site, medRxiv, hosts preprints within the medical sciences. Owned by Cold Spring Harbor Laboratory.

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Lecture 1: Technical Writing

Reference management tools

- **Zotero**: free and open source (https://www.zotero.org/)
- **Mendeley**: free web and desktop (https://www.mendeley.com/)
- **RefWorks**: accessed through the University of Cyprus (https://about.proquest.com/en/products-services/refworks/)
- **EndNote**: commercial (https://endnote.com/)
- **JabRef**: open-sourced, cross-platform. It uses Bibtex (https://www.jabref.org/)

- Several reference management tools enable sharing of libraries across multiple users

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Reading related work

- Reading good related work is basic
- Tips:
  - Selectivity is important
    - Skim the material. Read abstract, intro and conclusions first
    - Decide in how much detail to study
  - Take notes
    - Delays reading and can be tedious, **but**
    - Helps when you re-read
    - Details proportional to degree of relevance

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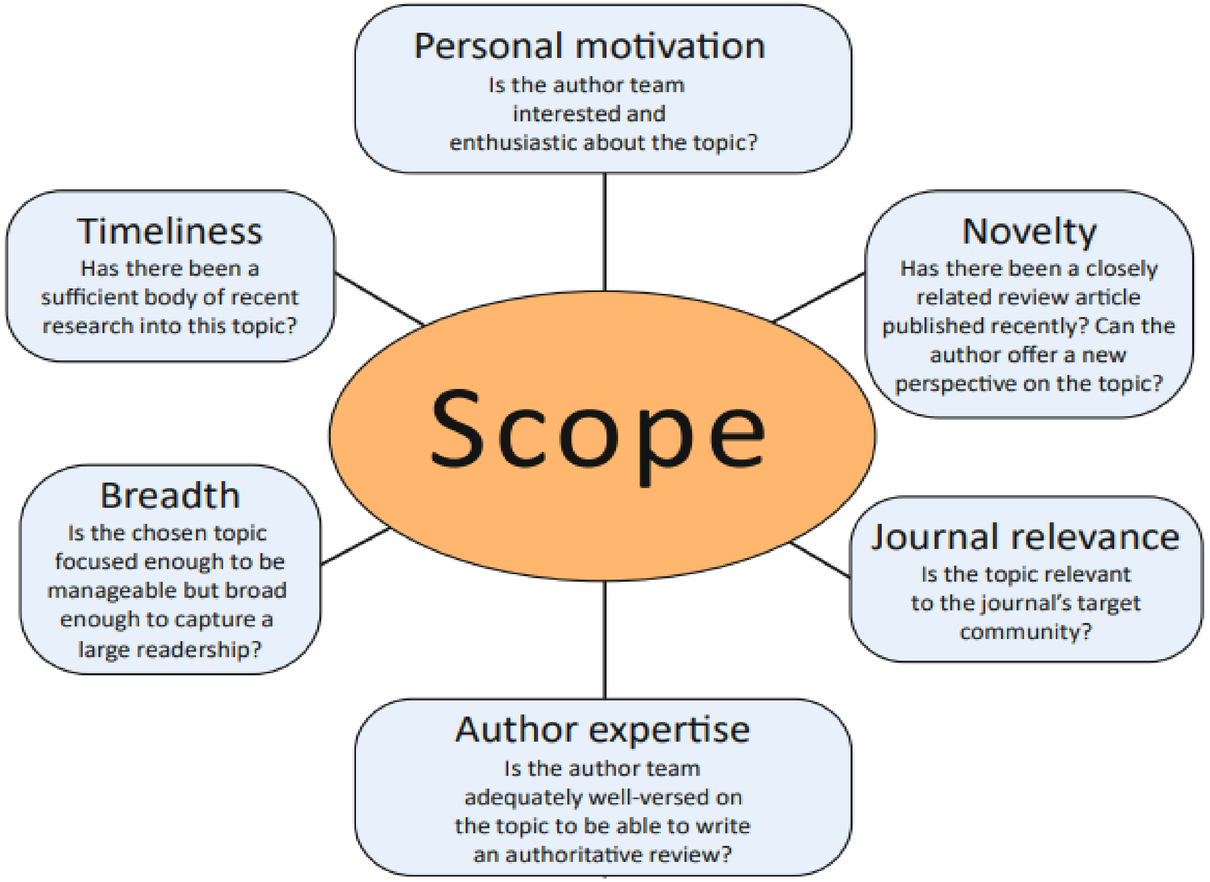
Lecture 1: Technical Writing



A summary of key factors that authors should consider when pinpointing the scientific focus of a review article

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Ask yourself questions

- what is the contribution of this paper?
- what techniques/methods have been applied?
- what is the author's thesis?
- how does the author go about convincing you?
- does the author succeed?
- how the work differs form other works?
- author's future work? New ideas generated?
- what can I learn about writing?

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Writing the review

- An essay rather than a list of papers
  - start by linking the summaries
- Place works in context and relate them
- Avoid detailed descriptions
  - space devoted ~ significance of the work
- **Limit (≈0)** number of direct quotations

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Lecture 1: Technical Writing

Think visually

- Figures and Tables break up long sections of text to make the content more engaging and easier to follow.
  - ➢ Added benefit to help you to stay in the word limit

- Software for generating scientific illustration i.e. Adobe Illustrator, InkScape, BioRender
- Remember to cite all the figures and tables sequentially in numerical order.
- For journal papers: Consult the target journal's guidelines on optimum font size and type and ensure that you use the same font consistently within and across figures.

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Be an original

- It’s natural to get inspired by other authors’ words and description when you write your own review article.
- But be careful not to plagiarize them
- Plagiarism detection software such as iThenticate or other alternatives (https://alternativeto.net/software/ithenticate/?license=free)
- Use online translation tools if English is not your native language
  - Look for synonyms

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Lecture 1: Technical Writing

Core components of a typical review article

- Abstract: 150 – 200 words
- Introduction: 300- 500 words
- Main text: 3500 – 5000 words
- Conclusions: 350 – 500 words
- References/bibliography

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The title

- **Meaningful and brief (“catchy”)**
  - Someone reading references/titles should be able to work out likely content
  - Avoid very specific titles
  - Don’t make jokes

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Abstract

- Executive summary
  - high-level description of content
- Attract attention (get reader read more)
- Try for one sentence or so on:
  - Problem/Motivation/Importance
  - Method
  - Key Result/Contribution
  - Conclusions

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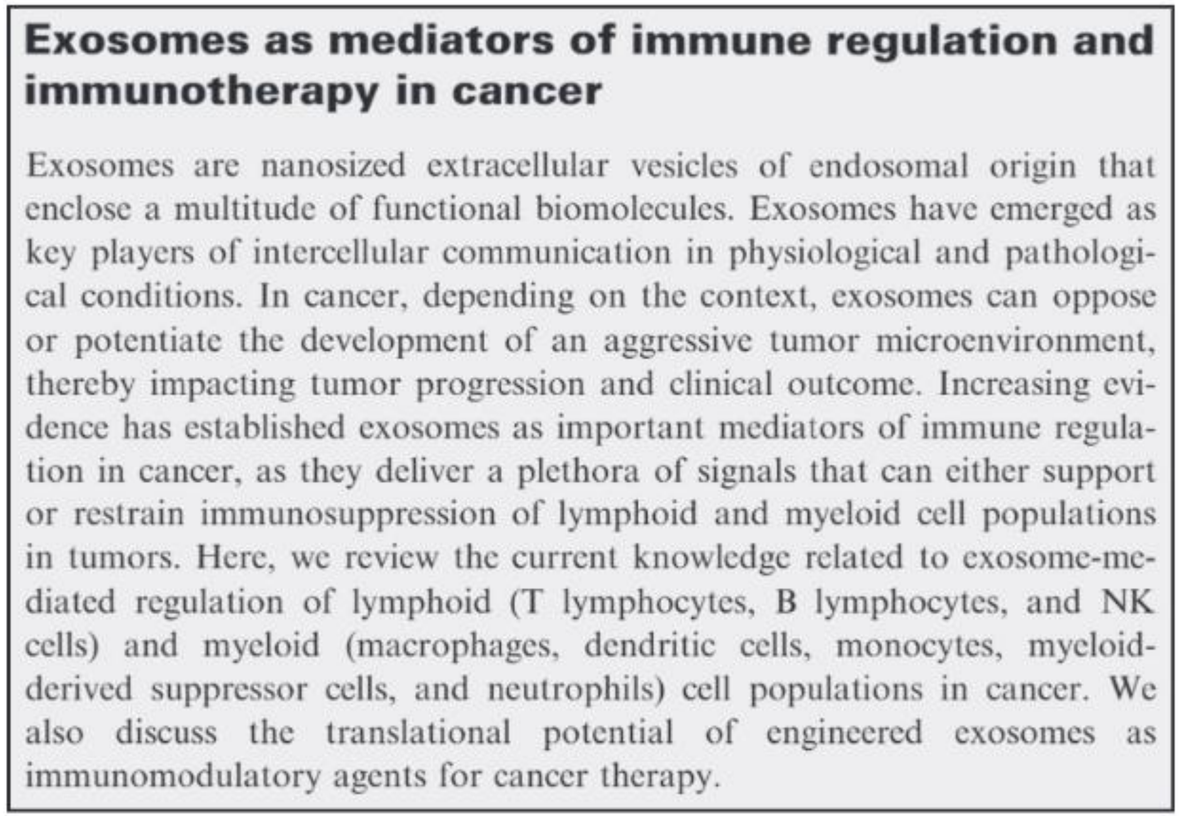
Abstract: An example



Exosomes as mediators of immune regulation and immunotherapy in cancer

Exosomes are nanosized extracellular vesicles of endosomal origin that enclose a multitude of functional biomolecules. Exosomes have emerged as key players of intercellular communication in physiological and pathological conditions. In cancer, depending on the context, exosomes can oppose or potentiate the development of an aggressive tumor microenvironment, thereby impacting tumor progression and clinical outcome. Increasing evidence has established exosomes as important mediators of immune regulation in cancer, as they deliver a plethora of signals that can either support or restrain immunosuppression of lymphoid and myeloid cell populations in tumors. Here, we review the current knowledge related to exosome-mediated regulation of lymphoid (T lymphocytes, B lymphocytes, and NK cells) and myeloid (macrophages, dendritic cells, monocytes, myeloid-derived suppressor cells, and neutrophils) cell populations in cancer. We also discuss the translational potential of engineered exosomes as immunomodulatory agents for cancer therapy.

Example of a good title and abstract for a review article. Screenshot of the title and abstract of a review article published by Fernanda G. Kugeratski and Raghu Kalluri, in the FEBS Journal. The title and abstract succinctly and clearly encapsulate the aims and scope of the article and the length, format and style align with standard journal guidelines.

Kugeratski FG, Kalluri R. Exosomes as mediators of immune regulation and immunotherapy in cancer.FEBSJ.2021;288:10−35.

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The Introduction

- Intro can decide destiny of a paper
- Must not be (very) technical
- Purpose:
  - introduce problem
  - motivation, significance
  - previous work (or other survey papers in a review article)
  - your contribution, *limitations*?
  - outline of the rest of the paper

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The Introduction

- The problem
  high-level description of problem:
  what is the problem?
  motivation + significance:
  why is the problem interesting?
- Related work
  place paper in context
  one line per paper (details later)

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The Introduction

- Your contribution
  - high-level description of your solution
  - what does it achieve?
    - list of results and contributions
  - originality
  - state clearly and explicitly
- “The rest of the paper is organized as follows. Section 2……”

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Background

- Sets the scene
- Defines formalism, notation, technical preliminaries
- Get reader up to speed
- Makes paper self-contained (as possible)
- Identifies research problem
- Sometimes it can interleave with introduction

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Main Text (for a research paper)

- Related Work
  - Divided into subsections, each focus on a subproblem
- Methodology
  - Methods/techniques used
  - Dataset(s) used
  - Divided into subsections
- Results – Discussion
  - Both visual and textual

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Main Text (for a review paper)

- Method
  - Method used to collect/organize the related work papers
- Related Work
  - Methods/techniques used in related works
  - Dataset(s)/automated tools used
  - Divided into subsections (sub-topics)
  - Comparative analysis (using tables)
- Discussion
  - Both visual and textual
  - Critical discussion

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Conclusions

- Some suggest to keep it minimal
- What to put
  - Overview of what you have done
  - Main results and contribution (do not c/p)
  - Comments on importance and practical use
  - Place work in wider context
  - What general lessons might be learnt from this study?
  - Future work/Limitations

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Ethics Statement

- …notes the paper should:
- be the authors' own original work, not previously published elsewhere
- reflect the authors' own research and analysis-- in a truthful and complete manner
- properly credit the meaningful contributions of co-authors and co-researchers
- not be submitted to more than one journal for consideration, and
- be appropriately placed in the context of prior and existing research.

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Reference Management Tool (Zotero Tutorial)

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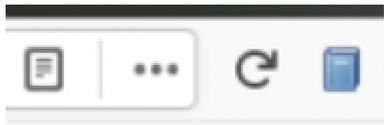
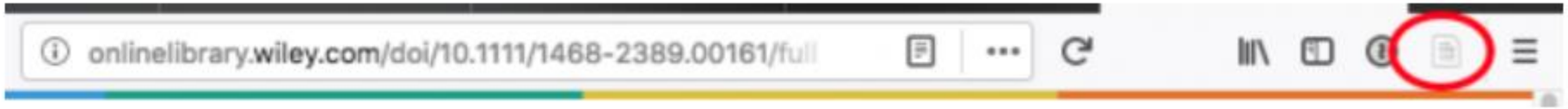
Zotero Connector

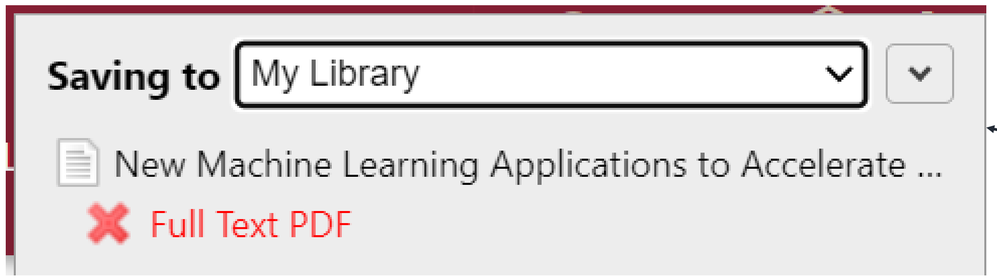
- Connect Zotero with your web browser π.χ. Chrome, Microsoft Edge, Safari for a quick saving of the references.

- Save button – (the button with the red in the icon) saves an article/book.



- αποθήκευση βιβλίων





Choose a directory to save the article

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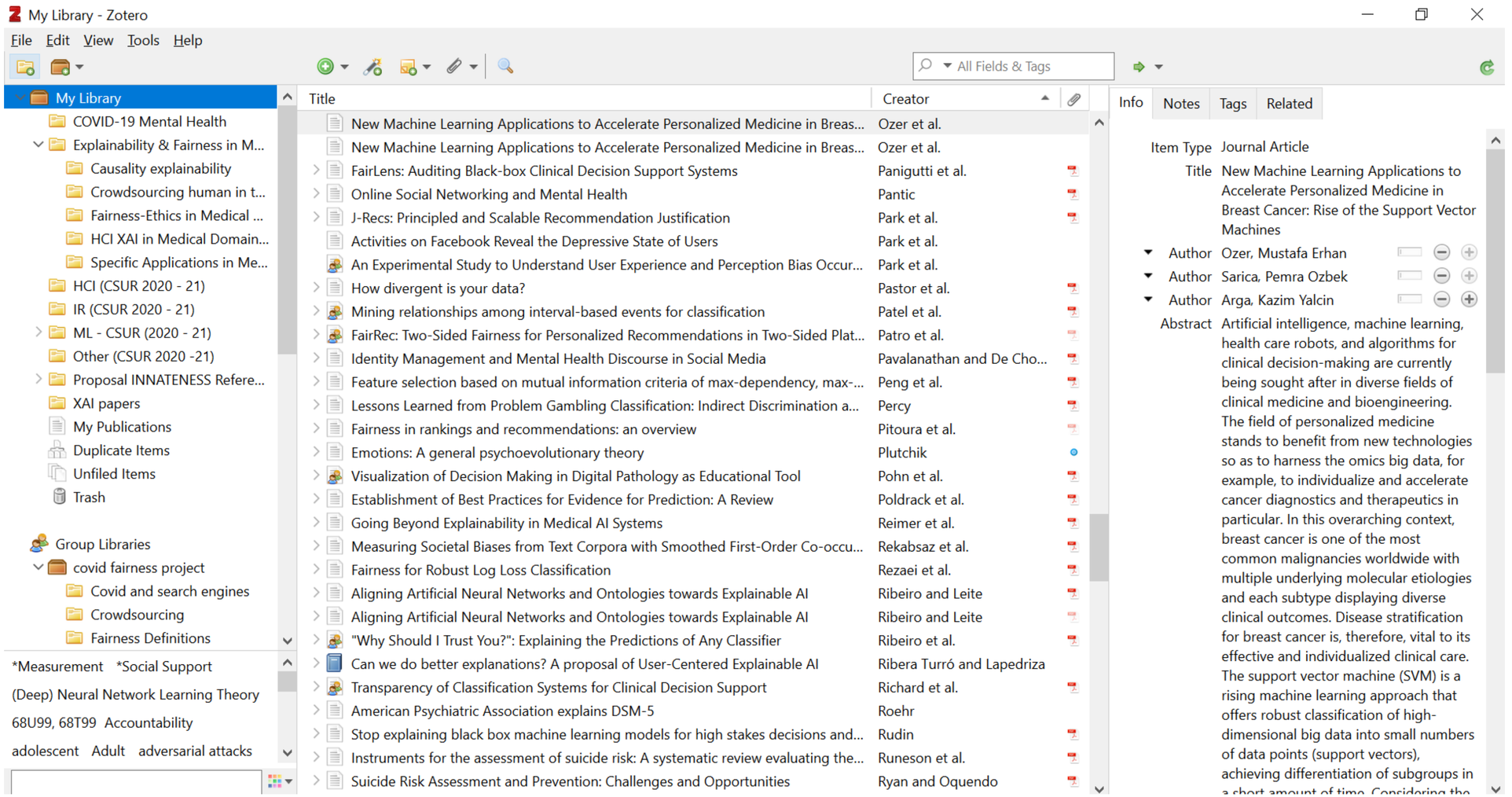
Zotero - Desktop



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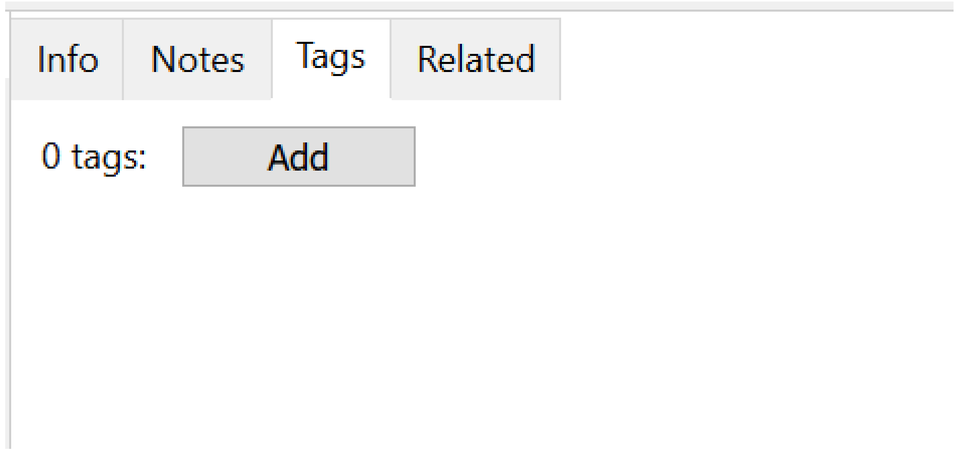
Keywords- Notes

- Select a reference and add any keywords, tags or other details.



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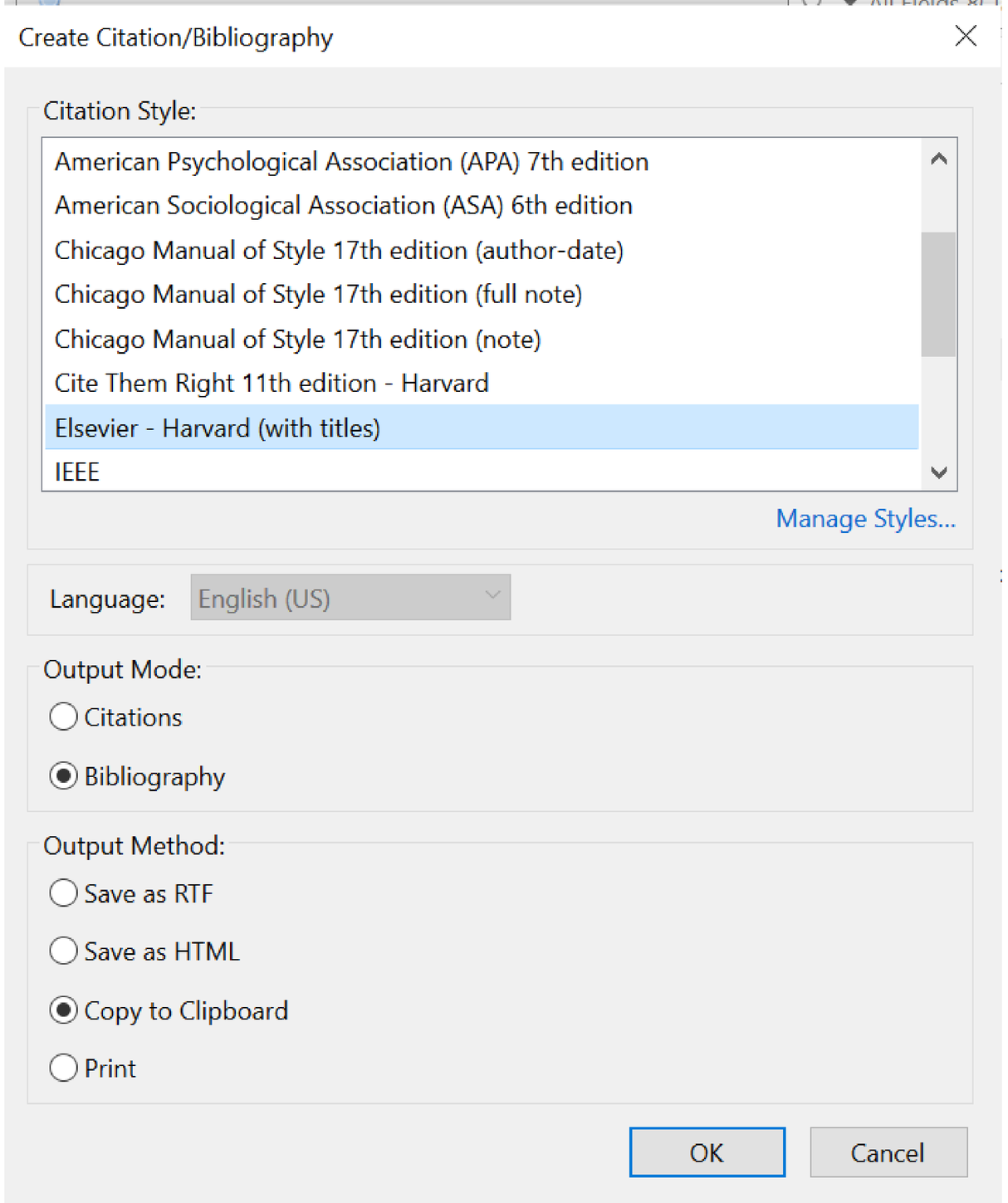
Create Citation/Bibliography
Citation Style:
American Psychological Association (APA) 7th edition
American Sociological Association (ASA) 6th edition
Chicago Manual of Style 17th edition (author-date)
Chicago Manual of Style 17th edition (full note)
Chicago Manual of Style 17th edition (note)
Cite Them Right 11th edition - Harvard
Elsevier - Harvard (with titles)
IEEE
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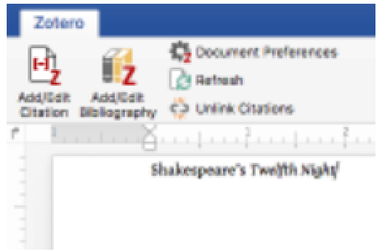
English (US)
Output Mode:
Citations
Bibliography
Output Method:
Save as RTF
Save as HTML
Copy to Clipboard
Print
OK
Cancel

Zotero – Word Plugin

Zotero Plugin Tab

Installing the Zotero Word plugin adds a Zotero tab to Microsoft Word. (In Word 2008 for Mac the script menu is used.)



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Add/Edit Bibliography		Insert a bibliography at the cursor location or edit an existing bibliography.
Document Preferences		Open the Document Preferences window, e.g. to change the citation style.
Refresh		Refresh all citations and the bibliography, updating any item metadata that has changed in your Zotero library.
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References

- https://www.youtube.com/watch?v=RuRF8zxkxIo#!
- https://www.zotero.org/support/word_processor_plugin_usage
- https://www.zotero.org/support/word_processor_integration
- https://library.ucy.ac.cy/literature-support/citation-management/

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University of Cyprus

MAI613: Research Methodologies and Professional Practices in AI

Dr Kalia Orphanou

Fall Semester 2022

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Lecture 2: How to give a great talk

How to give a great talk - Contents

- Why bother to give a good talk
- Types of presentations
- Top 10 pointers for good talk
- A typical project talk outline
- Your audience
- Your key idea

“A successful talk is a little miracle—people see the world differently afterward.”

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Lecture 2: How to give a great talk

Why bother to give a great talk?

- First impressions matter!
- There's no point doing good work if others don't know about it or can't understand what you did.
- Good practice for a teaching career! Good practice for any career!
- Helps you sort out what you've done and understand it better yourself.

Slides adapted from Margaret **Martonosi** and Iris **Bahar**. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

Types of Presentations

- Quick 1-minute “what I do” talk
- 25-minute conference paper presentation
- Project presentation (i.e. contest, poster presentation, events)
- Thesis defense
- Job talk

What they have in common:

- Never enough time to talk about everything
- All of them reflect on you & need practice/polish
- Focus on a clear goal and message

Slides adapted from Margaret **Martonosi** and Iris **Bahar**. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

Research is communication

- Think how often did you say: “I am really glad I went to that talk”
- Why you should listen to a talk:
  - Networking with other researchers working on this field
  - Listen to some ideas that can help you on your research

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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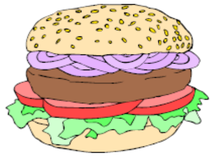
Lecture 2: How to give a great talk

What your research talk is for:

- Your paper = **The beef**



- Your talk = **The beef advertisement**

Do not confuse the two

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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The purpose of your talk

- The purpose of your talk is **not:**
  - ➢ to impress your audience with your brainpower
  - ➢ to tell them all you know about your topic
  - ➢ to present all the technical details

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

The purpose of your talk

- The purpose of your talk **is:**
  - to give your audience an intuitive feel for your idea
  - to make them foam at the mouth with eagerness to read your paper
  - to engage, excite, provoke them
  - to make them glad they came

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Your audience:

- The audience you **would like**:
  - Have read all your earlier papers
  - Thoroughly understand all the relevant theory of your presenting paper
  - Are all excited to hear about the latest developments in your work
  - Are fresh, alert, and ready for action

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

- The **real audience** would:
  - Have never heard of you
  - Have heard of your research, but wish they hadn't
  - Have just had lunch and are ready for a doze

Your mission is to
WAKE THEM UP
And make them glad they did

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Examples are your main weapon:

- To motivate the work:
  - To convey the basic intuition
  - To illustrate the idea in action
  - To show extreme cases
  - To highlight shortcomings

When time is short, omit the general case, not the example

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Top 10 pointers for a good talk

1. Be neat
2. Avoid trying to cram too much into one slide
   - Don’t be a slave to your slides
3. Be brief
   - Use keywords rather than long sentences
4. Avoid covering up slides
5. Use a large font
6. Use color to emphasize

Slides adapted from Margaret **Martonosi** and Iris **Bahar**. How to Give a Good Presentation. Princeton University, August 2008

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Top 10 pointers for a good talk

7. Use illustrations to get across key concepts
    - May include limited animation
8. Make eye contact
9. Be ready to skip slides if time is short
10. Practice

Slides adapted from Margaret **Martonosi** and Iris **Bahar**. How to Give a Good Presentation. Princeton University, August 2008

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A Typical Project Talk Outline

- Title/author/affiliation (1 slide) — Who am I?
- Forecast (1 slide)
  - ➢ Give gist of problem attacked and insight found
- Outline (1 slide)
- Background — Why is it important?
  - Motivation and Problem Statement (1-2 slides)
  - Related Work (0-1 slides) — What have others done?
  - Methods (1-3 slides)
    - ➢ Explain your approach; illustrate algorithm — What is my approach?

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Lecture 2: How to give a great talk

A Typical Project Talk Outline

- Results (2-6 slides)
  - Present key results and key insights. This is main body of the talk, but don't try to show ALL results
- Summary (1 slide)
- Future Work (0-1 slides)
- Backup Slides (0-3 slides)
  - Optionally have a few slides ready to answer expected questions.

Slides adapted from Margaret **Martonosi** and Iris **Bahar**. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

Your Key Idea

If the audience remembers only one thing from your talk, what should it be?

You must identify a key idea. “What I did this summer” is No Good.

- **Be specific.** Don’t leave your audience to figure it out for themselves.
- **Be absolutely specific.** Say “If you remember nothing else, remember this.”
- Organise your talk around this specific goal. Ruthlessly prune material that is irrelevant to this goal.

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Do not present related work

But:

- You absolutely must know the related work; respond readily to questions
  - ➢ Acknowledge co-authors (title slide), and pre-cursors (as you go along)
  - ➢ Praise the opposition “X’s very interesting work does Y; I have extended it to do Z”

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Omit technical details

- Even though every line is drenched in your blood and sweat, dense clouds of notation will send your audience to sleep.
- Present specific aspects only; refer to the paper for the details
- By all means have backup slides to use in response to questions

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Other Things to Consider

- Oral communication is different from written communication
  - ➢ Keep it simple and focus on a few key points
  - ➢ Repeat key insights
- Be sensitive to your audience
  - ➢ The same talk may need to be adjusted for a different audience
- Make the audience want to learn more
- Handling Q&A is as important as the formal talk itself

Margaret Martonosi and Iris Bahar. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

How to Improve?

- Practice by yourself
- Practice in front of friends
- Practice in front of a webcam
  - ➢ Watch footage later… alone… as painful as that may be!
- Take note of effective speakers and adopt their successful habits

Margaret Martonosi and Iris Bahar. How to Give a Good Presentation. Princeton University, August 2008

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How to Present Your Talk?

- Your most potent weapon, by far, is your

enthusiasm

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Enthusiasm

- If you do not seem excited by your idea, why should the audience be?
  - It wakes them up
  - Enthusiasm makes people dramatically more receptive
  - It gets you loosened up, breathing, moving around

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Write your slides the night before

- Your talk must be fresh in your mind
- Ideas will occur to you during the conference while listening to others' presentations
- Even better **polish it** the night before

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Do not apologise

- “I didn’t have time to prepare this talk properly”
- “My computer broke down, so I don’t have the results I expected”
- “I don’t have time to tell you about this”
- “I don’t feel qualified to address this audience”

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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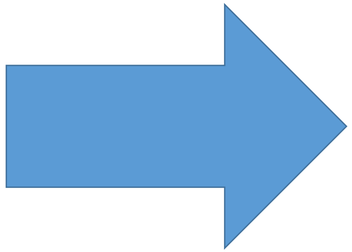
Lecture 2: How to give a great talk

Pre-talk Symptoms

- Excessive stress
- Fast or very slow breathing
- You think that you forgot everything
- Inability to stand up



- Script you first sentences (or memorize)
- Write the whole talk in notes
- Deep breathing during the previous talk

Simon Peyton Jones, Microsoft Research, Cambridge, 1993

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Lecture 2: How to give a great talk

Questions

- Questions are not a problem

> Questions are a golden golden golden opportunity to connect with your audience

- Specifically encourage questions during your talk: pause briefly now and then, ask for questions
- Be prepared to truncate your talk if you run out of time
- Better to connect, and not to present all your material

Margaret Martonosi and Iris Bahar. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

Finishing

- Finish on time
- Audience stop listening when your time is up
- Skip some slides and conclude

Margaret Martonosi and Iris Bahar. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

Communication and your Career

- Expressing yourself technically helps you make and use professional connections wisely.
- You are joining a long-term community…
- Communicate your ideas to forge mentoring and technical relationships in the service of professional goals.

Margaret Martonosi and Iris Bahar. How to Give a Good Presentation. Princeton University, August 2008

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Lecture 2: How to give a great talk

Do It! Do It! Do It!

Good papers and talks are a fundamental part of research excellence

- Invest time
- Learn skills
- Practice

Write a paper, and give a talk, about **any idea**, no matter how weedy and insignificant it may seem to you

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Lecture 2: How to give a great talk

Discussion

- Remember at least one presentation/talk that you really like.
  - How the speaker managed to keep you motivated?
  - Did you notice anything from the tips discussed?
- Do you think that body language is also important during the presentations?
- What do you remember from your previous presentations?
  - What do you like to improve?
  - How do you handle your stress before/during the presentation?

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Lecture 2

Interactive Exercise

Work in pairs

- The person in the left to discuss their topic to the person in the right (5 minutes)
- The person in the right should ask questions (2-3 minutes)

- Repeat the same exercise standing up

- Any thoughts?

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Lecture 2: How to give a great talk

Useful links for videos

- How to give a great research talk, Simon Peyton Jones, Microsoft Research, https://www.youtube.com/watch?v=sT_-owjKIbA
- TED's secret to great public speaking, Chris Anderson, https://www.youtube.com/watch?v=-FOCpMAww28
- The 3 Magic Ingredients of Amazing Presentations, Phil WAKNELL, TEDxSaclay, https://www.youtube.com/watch?v=yoD8RMq2OkU&t=25s
- What makes a great talk, great, Chris Anderson at TEDGlobal 2013, https://www.youtube.com/watch?v=hhbvUZOLTQY

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University of Cyprus

MAI613: Research Methodologies and Professional Practices in AI

Dr Kalia Orphanou

Fall Semester 2022

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Lecture Outline

1. Purpose of EC regulatory framework
2. Classification of AI applications based on risk categories
3. Obligations for providers of high-risk AI systems
4. Examples of AI systems of each category
5. Bias in AI systems
6. Transparency in AI Systems

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Commissioner for Internal Market Thierry **Breton** said:

"AI is a means, not an end. It has been around for decades but has reached new capacities fueled by computing power. This offers immense potential in areas as diverse as health, transport, energy, agriculture, tourism or cyber security. It also presents a number of risks. Today's proposals aim to strengthen Europe's position as a global hub of excellence in AI from the lab to the market, ensure that AI in Europe respects our values and rules, and harness the potential of AI for industrial use."

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Purpose of Regulatory Framework on AI

- There are multiple benefits of AI in the society **but many** AI systems create risks that need to be addressed to avoid undesirable outcomes.
- A clear and predictable legal framework that address the technological challenges is necessary.
- EU proposes the regulatory framework on AI to ensure **user safety**, as well as increasing **user trust** in emerging technologies.
- **Biometric identification** systems are included in this framework
  - AI decisions related on important personal interests such as in the area of education, healthcare, recruitment.

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AI Systems Characteristics

- Safety
  - Product security
  - Mental safety (user safety)

- Connectivity
  - Indirectly the product can be hacked leading to security threats and affecting the safety of users i.e. children smartwatch
  - Cyber-threads of industrial applications

Source: Report on the safety and liability implications of Artificial Intelligence, the Internet of Things and robotics, 2020

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AI Systems Characteristics

- Autonomy
  - Self-learning feature of AI products and systems enable the machine to take decisions that are different from what the user expects.
  - May harm mental health i.e. AI humanoid robots
- Opacity
  - Black-box models
  - Decision-making process of the system is difficult to trace
  - Especially in critical domains, humans should understand how AI reaches a decision
  - Transparency, robustness, accountability, unbiased outcome to build trust

Source: Report on the safety and liability implications of Artificial Intelligence, the Internet of Things and robotics, 2020

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The proposed rules will:

- address risks specifically created by AI applications;
- propose a list of high-risk applications;
- set clear requirements for AI systems for high-risk applications;
- define specific obligations for AI users and providers of high-risk applications;
- propose a conformity assessment before the AI system is put into service or placed on the market;
- propose enforcement after such an AI system is placed in the market;
- propose a governance structure at European and national level.

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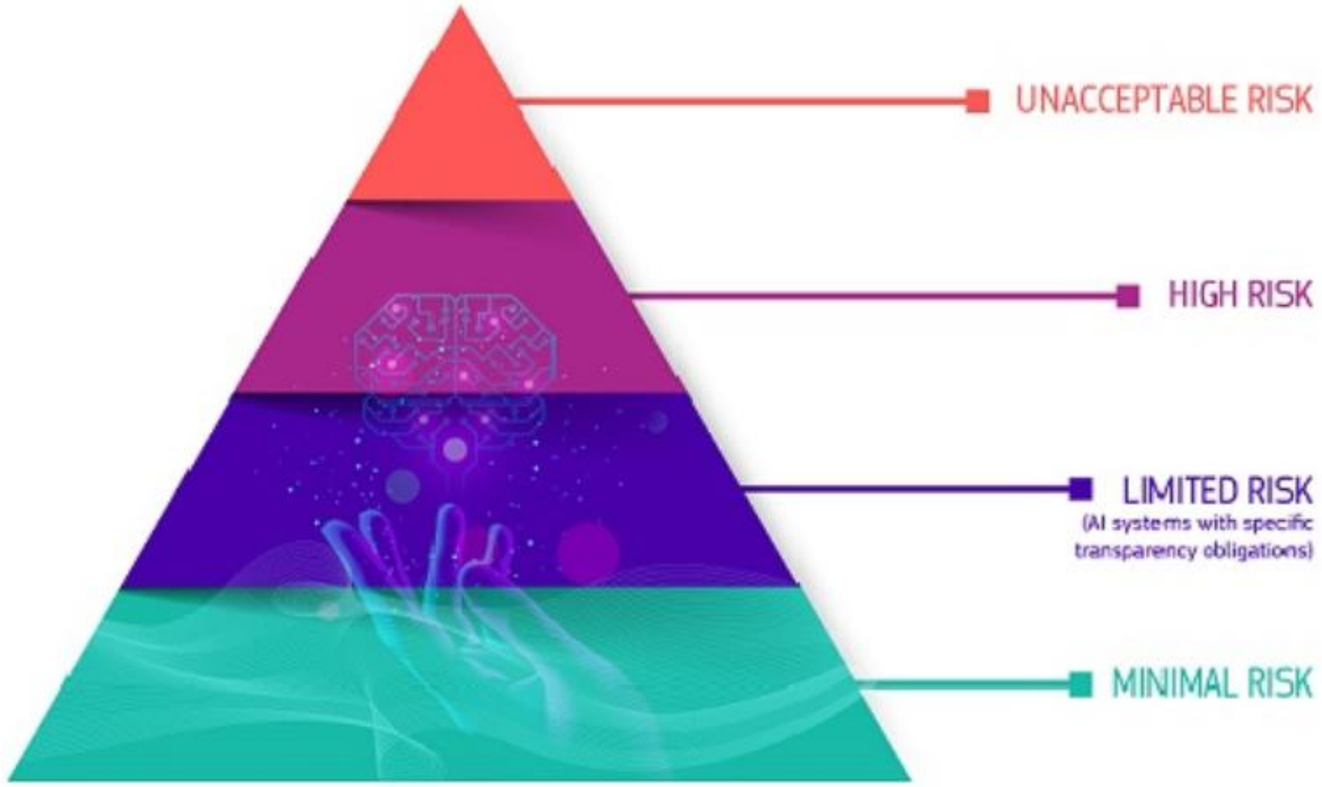

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Risk Categories of AI Systems

- **Unacceptable Risk:** A very limited set of harmful AI applications that violate the fundamental rights i.e. exploitation of vulnerabilities of children, live remote biometric identification systems in publicly accessible spaces.

- **High Risk:** A limited number of AI systems that creates an impact on people's safety or their fundamental rights.

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Risk Categories of AI Systems

- **Limited Risk:** In AI applications where there is a clear risk of manipulation. In limited risk applications, transparency requirements are proposed such as users should be aware that they are interacting with machines.

- **Minimal Risk**: All the rest of AI systems/applications can be used based on the existing legislation without additional legal obligations. The vast majority of AI systems belong to this category.

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Unacceptable Risk AI Systems - Examples

Social scoring by government systems. Source by: https://www.eupoliticalreport.eu/artificial-intelligence-and-social-scoring/

- Ban in social scoring systems by public authorities in Europe.
- In China, the governments use social scoring to deny people access to public services.

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Unacceptable Risk AI Systems - Examples

- Smart toys using voice assistance encourages dangerous behavior.
- Toys such as smart dolls apps i.e. Cayla, that use AI to collect data about the child so that they will personalize the gaming/learning activities.

  The company that builds the toy can sell these data.
  - ➢ Makes the child extremely vulnerable
  - ➢ Someone can hack the device and communicate directly with the child.
  - ➢ Germany banned Cayla dolls and other similar games.

Source: https://myfriendcayla.co.uk/

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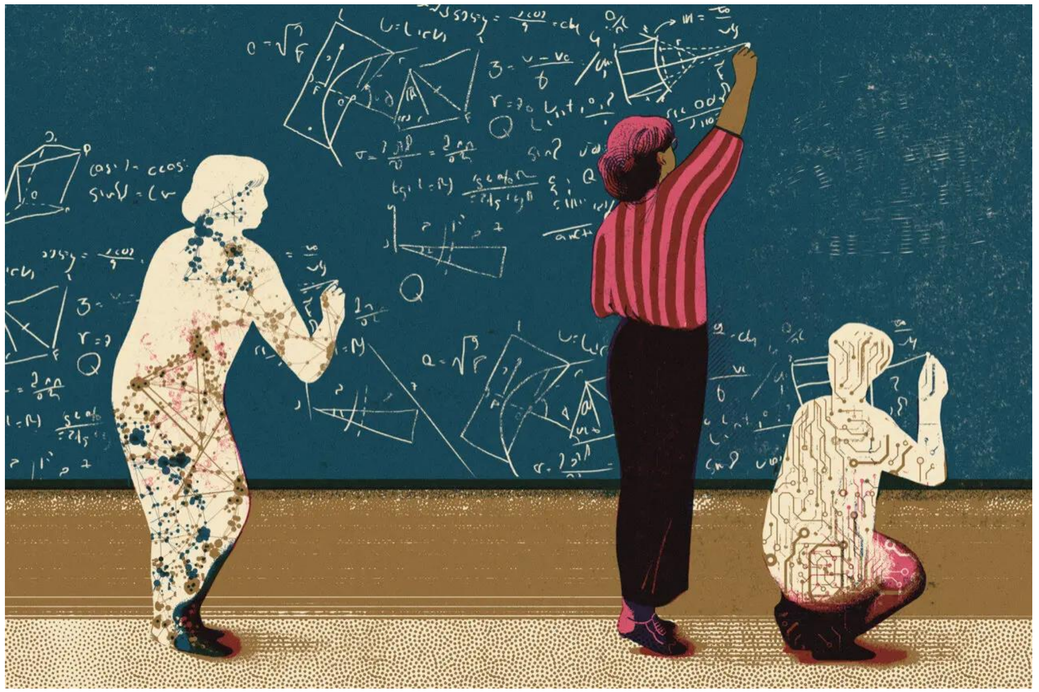
High Risk AI Systems Examples

Tesla self-driving car. Source: https://www.bbc.com/news/business-52703767



AI (Neural network) provide automatic feedback to students. Source: New York times (https://www.nytimes.com/2021/07/20/technology/ai-education-neural-networks.html)

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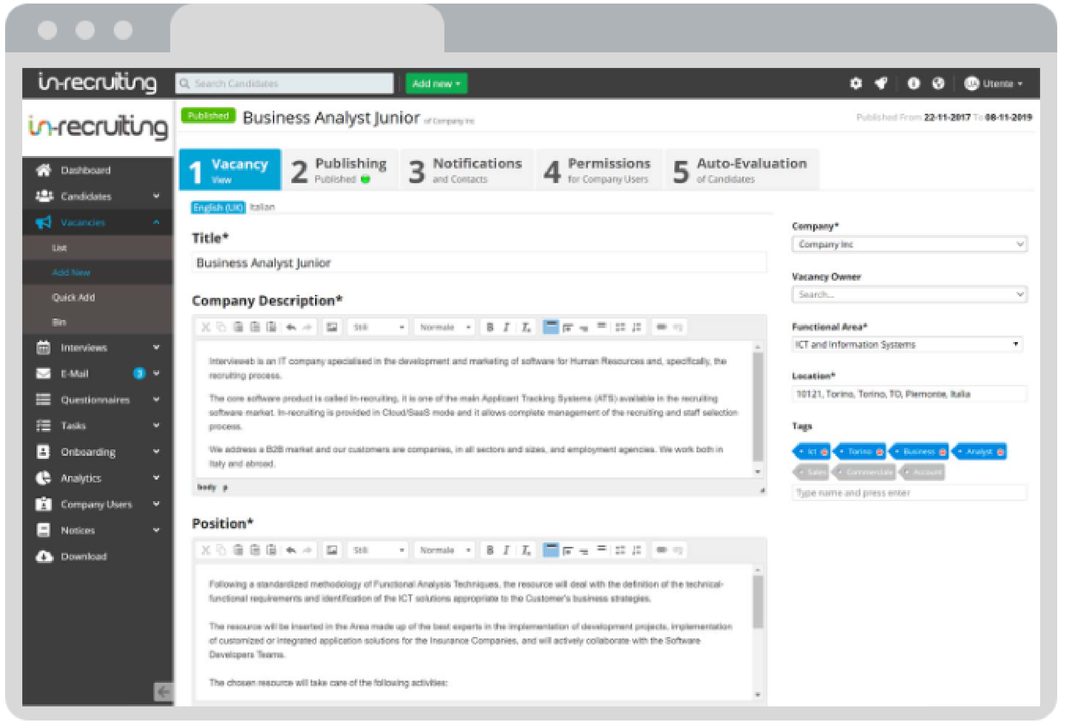
High Risk AI Systems Examples

Surgeons operating on someone's arm using a robot Source: MIT Technology Review



CV-sorting software for recruitment using AI. Source: https://www.in-recruiting.com/en/solutions/companies/

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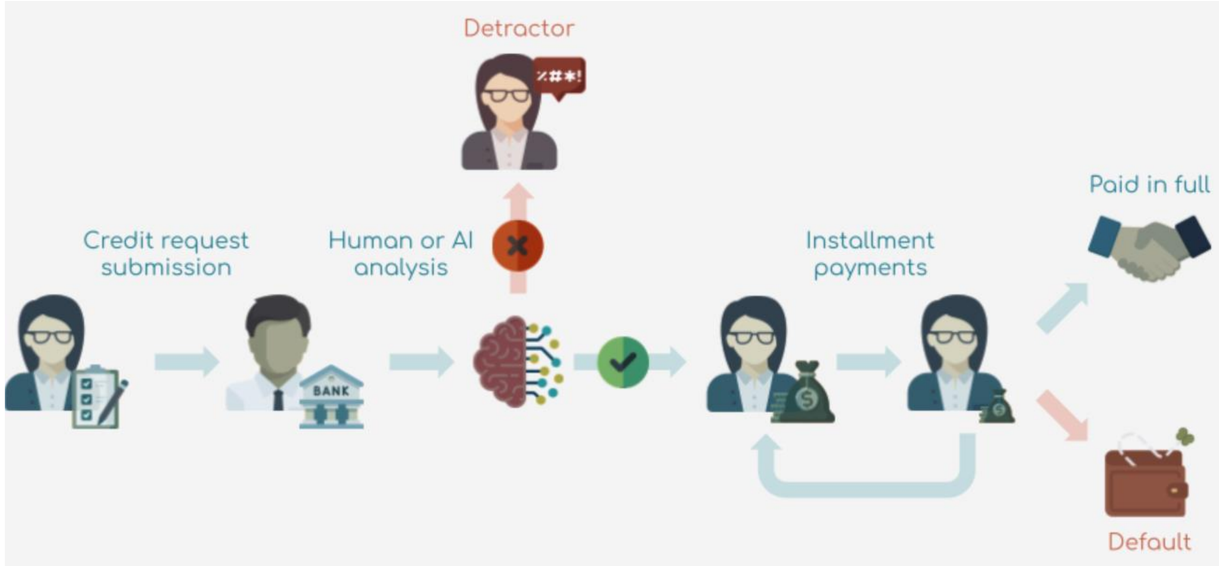
High Risk AI Systems Examples



Credit score using AI. Source: https://nilg.ai/blog/202107/insights-in-ai-applied-to-credit-scoring/

Biometric identification. Your selfie, your new password. Source: https://www.global-imi.com/index.php/blog/biometrics-your-selfie-your-next-password

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Other High-Risk AI Systems

- Law enforcement that may interfere with people's fundamental rights (e.g. evaluation of the reliability of evidence);
- Migration, asylum and border control management (e.g. verification of authenticity of travel documents);
- Administration of justice and democratic processes (e.g. applying the law to a concrete set of facts).

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Obligations for High-Risk AI Systems

- Risk management
- Data governance (managing the availability, usability, integrity and security of the data)
- Technical documentation
- Record keeping (traceability)
- Transparency and provision of information to users
- Human oversight (**the capability for human intervention in every decision cycle of the system)**
- Accuracy
- Cybersecurity robustness

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Obligations for Providers of High-Risk AI Systems

- To do a conformance testing before to place a high-risk AI system on the EU market.
- The system should comply with the mandatory requirements for trustworthy AI (e.g. data quality, documentation and traceability, transparency, human oversight, accuracy and robustness).
- In case the system itself or its purpose is substantially modified, the assessment will have to be repeated.
- For biometric identification systems, a third-party conformity assessment is always required.

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Obligations for Providers of High-Risk AI Systems

- Providers of high-risk AI systems will also have to implement **quality and risk management in their systems** to ensure their compliance with the new requirements even after a product is placed on the market.
- Multiple audits from authorities will help on monitoring the high-risk AI systems after placing them on the market.

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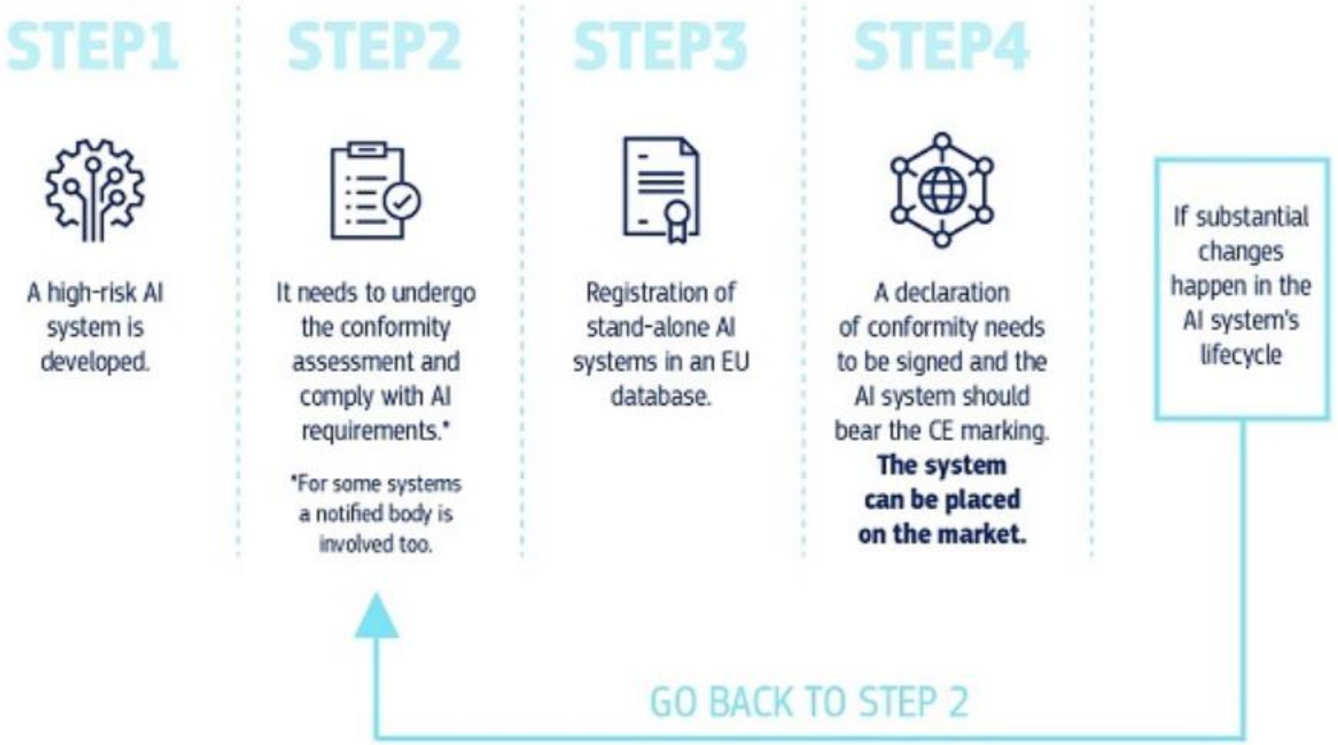
How to Handle High-Risk AI Systems



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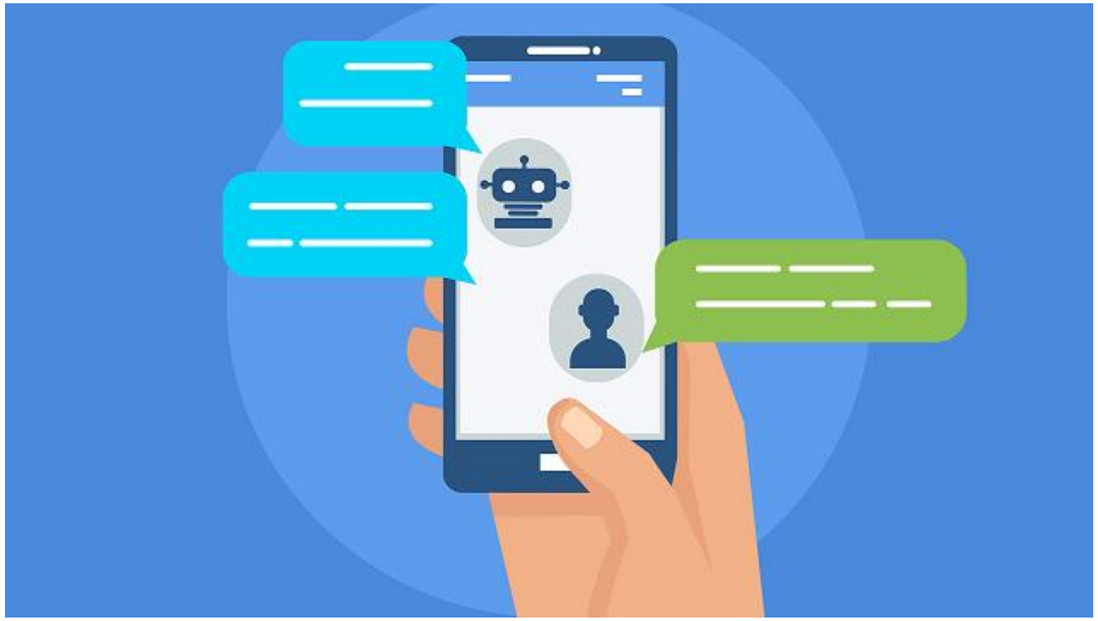
Limited Risk AI Systems Examples



Chatbots Source: Aalpha information systems (https://www.aalpha.net/articles/chatbot-app-development-advantages-and-disadvantages/)

Voice Assistants – Source: BBC news (https://www.bbc.com/news/technology-56602321)

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Minimal Risk AI Systems Examples

AI video games: Virtual Reality Photo by Harsch Shivam

Source: github.com

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Voluntary Codes of Conduct

- Providers of non-high-risk applications can ensure that their AI system is trustworthy by developing their own voluntary codes of conduct.
- Or by following the codes of conduct adopted by other representative associations.

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Accountability and Transparency in AI Systems

- The complexity and opacity (“**black-box models**”) of some AI systems make their evaluation based on the fundamental rights legislation more difficult.
- A human-centric approach to AI means to ensure AI applications comply with fundamental rights legislation.
- Accountability and transparency requirements for the use of high-risk AI systems, combined with improved enforcement capacities, will ensure that legal compliance is factored **at the development stage**.

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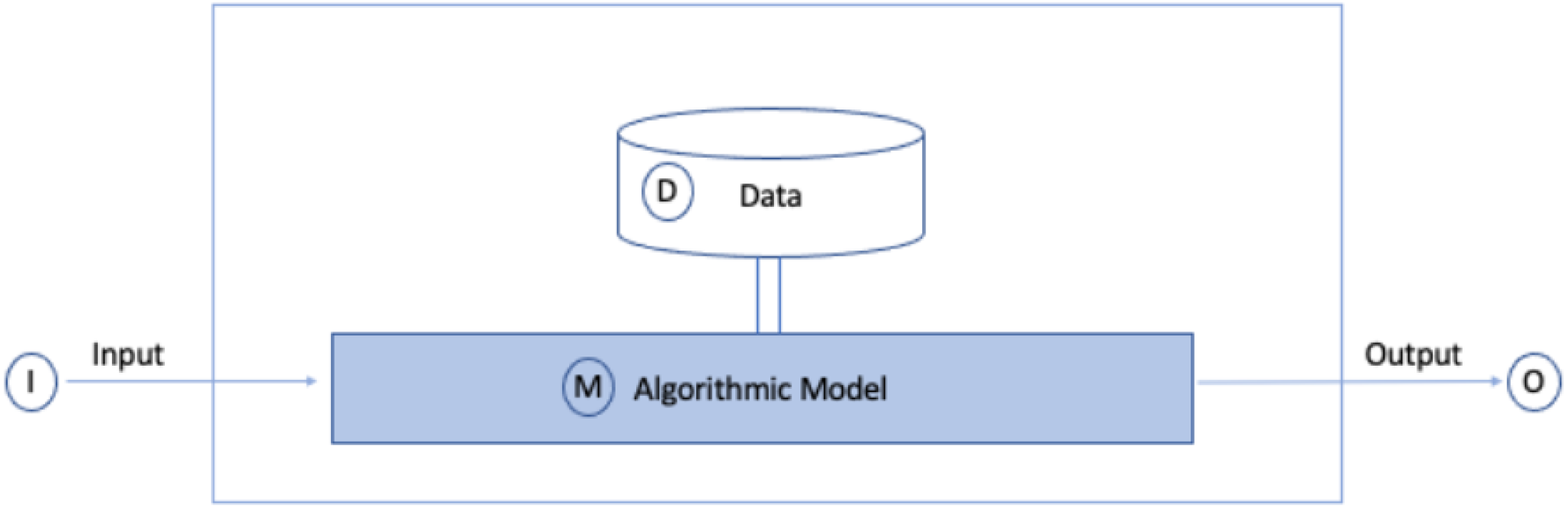
AI Decision-Making System



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Bias in AI Systems

- "a disproportionate weight *in favor of* or *against* an idea or thing, usually in a way that is closed-minded, prejudicial, or unfair." Source: Wikipedia
- Multiple sources:
  - Input data
  - Training data
  - Algorithmic model
  - Output

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Mitigating Bias in AI Systems

- AI systems should not create or reproduce bias but instead to contribute to reduce bias and existing structural discrimination.
- The mandatory requirements for all the high-risk AI systems is to ensure that the output of the system is not disproportionately affecting protected groups (e.g. racial or ethnic origin, sex, age etc.)
- Auditing and other bias detection methods should be applied in high-risk AI systems
- Bias mitigation approaches will be used to reduce bias and discrimination based on the source of bias.
- Detailed documentation should be kept regarding the datasets used for the model training and testing (system transparency)

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Transparency in AI Systems

- The decision process of the algorithmic models should be traceable
  - Use of interpretable ML models
  - Explainable AI techniques for black-box models
    - Black-box models: Deep learning, SVM, neural networks
- Be able to justify the particular decision outcome

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Regulatory Framework in AI vs GDPR

- Both set a global standard to respect the fundamental rights
- The requirements and obligations apply to providers and users of AI systems in the EU, regardless of whether AI systems are located in or outside the EU
- The penalty scheme is similar
- The methodology includes self-assessments (third-party assessments for biometric identification applications) to check if they conform the requirements and continuous monitoring.
- Accountability obligations require to keep a good documentation

Source: https://www.ey.com/en_es/law/european-draft-regulation-on-artificial-intelligence-key-questions-answered

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European Union: European Commission, ***New rules for Artificial Intelligence – Questions and Answers,*** Brussels, 21 April 2021

European Union: European Commission, ***Europe fit for the Digital Age: Commission proposes new rules and actions for excellence and trust in Artificial Intelligence, Press Release,*** 21 April 2021

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MAI613: Peer Review and General Comments

Dr. Kalia Orphanou

Fall 2022

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Lecture Outline

1. Peer review – Introduction
2. Peer review on journal vs conference papers
3. Examples and tips on how to address the comments
4. Feedback and tips for writing a survey paper
6. Storytelling in research
7. Interactive exercise

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Video: Peer Review Process for Research Publications

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Peer Review

Examples of Peer-review in a Journal Paper

- Be polite!!
- Details of the paper (title, manuscript number)
- Summary of the topic
- General comments (accept without changes, accept with minor changes, accept with major changes)
- Specific comments

General Comments:

1.The presentation of the paper is hard to follow. It would be better to re-structure the sections in the paper. For example, the limitations of probability and Bayesian theories should be a part of a section: Related Work - The following sections should also be included: a) Proposed Approach - which will describe the approach and specify the novelty of this work and b) The experimental analysis and the evaluation of this work (expert-based validation).

2.Expert-driven validation for a single patient path was used to evaluate this work. However, this is not sufficient, the approach should be tested on a number of patients either using statistical methods or expert knowledge.

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Peer Review

Peer-review for a Journal Paper - Example

Formatting Comments:

- Use the same format for Figures labels i.e. Figure 1, Figure 2 ..

Introduction:

- 1 or 2 paragraphs introducing fuzzy logic and evidence theory should be included in the introduction since the utilization of these two areas is the novelty of this research.
- Page 1: 3rd paragraph: The sentence “Selecting the most appropriate treatment package from differing options raises the possibility of potentially diverging… “ should be rephrased. What does the phrase “selecting one path will result in a developing..” means? Selecting any path but not the most appropriate one?

Section II:

- Authors should also refer to Nodelman et.al work on CTBN: Nodelman, Uri, Christian R. Shelton, and Daphne Koller. "Continuous time Bayesian networks." Proceedings of the Eighteenth conference on Uncertainty in artificial intelligence. Morgan Kaufmann Publishers Inc., 2002.

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Peer Review

Peer-review for a Conference Paper

*** REVIEW:

--- Please provide a detailed review, including justification for

--- your scores. This review will be sent to the authors unless

--- the PC chairs decide not to do so. This field is required.

% Please consider the following as a set of "rough guidelines" for what to

% include when writing a review for conference Y:

% * A short summary of the paper, plus what you think the "contribution" is

% * Aspects of the paper that you liked (flatter the author for a bit)

% * Things you didn't like (presentation, style, structure, overall

% technique, flaws, omissions, errors, spellings, etc.) -- be critical!

% * Things that should be changed (e.g., "maybe the authors could write X

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Peer Review

Peer-review for a Conference Paper

% * Suggestions for other improvements (e.g., "maybe the authors could compare their technique to Z")

% * A summary including your decision (e.g., "I think the paper presents a novel contribution to the field of XXX, and should/should not be accepted")

% The program committee really expects reviews to have four paragraphs, one for each of the following points as a bare minimum (with an optional fifth):

% 1) A summary of the paper

% 2) The good things

% 3) The bad things (+ suggested improvements)

% 4) A summary of your decision

% 5) Any suggested formatting alterations

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Peer Review

Addressing Comments of Peer Review - Example

- Create a Google doc with a table including all the comments (both from the instructor and the reviewer team)
- Number the comments
- Add a proposed solution to address the comment, person in charge, due date
- If you do not agree with any comment, add a note why this comment will not be addressed

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Figures/Illustrations

Figures, Tables and Illustrations

- To draw figures, illustrations:
  - Draw.io
  - Power BI
  - Tableau

- Add label and citation (if necessary) to every figure/table used in the paper
- Refer to that figure/table in the text and explain it briefly
- In academic research papers, the figures should be in vector format (.eps, .pdf)

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References

- Every part of your paper that is not your own idea, even if you re-write it on your own works
  - Apart from the abstract and conclusions
- Introduction
- Analysis of papers
  - Datasets (references or links)
  - Tools/apps (references or links)
  - Figures that you did not draw
  - References to other authors/works from one paper that you analyze (cite the authors who mention this piece)
- Add references after the author names
- Some parts of the text might have multiple references especially in the introduction or when you refer to several works used the same technique i.e. [2- 4]

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Analysis of Papers

Comparative Analysis

- Keep notes for specific parts that you are interested in each paper
  - Any terminology/definitions discussion that help you to understand the general topic
  - Dataset used (including a short description, any links/references)
  - Techniques used
  - General results

- Comparison of methods/results
  - Comparison with other works (already published) can be done only if applied to the same dataset using the same splitting criteria and evaluation metrics
  - Or re-run the same methods as proposed in the paper on the same dataset as yours
  - Table with numerical results are only useful if you compare the application of these techniques on the same dataset

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Analysis of Papers

Writing the Survey Paper

- Focus on one topic
  - One application
  - Refer to specific characteristics on which we will compare the different works i.e. techniques, datasets, evaluation, data collection
  - Understand what you write
  - A paper can be summarized even within two lines
- Use mainly present tense
- Acronyms in parenthesis – defined once and used through all the paper

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MAI4CAREU

Master programmes in Artificial Intelligence 4 Careers in Europe

University of Cyprus

MAI613: Research Methodologies and Professional Practices in AI

Interactive Exercise: Storytelling for presenting research

Dr Kalia Orphanou

Fall Semester 2022

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Interactive Lecture/Tutorial

Storytelling in Research

- A method to present your research (topic/findings)
- Written format: Using visualization/storytelling tools
- Oral format: Tell a story for your research
  - Video/movie
  - Use of multimedia

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Interactive Lecture/Tutorial

Benefits of Storytelling

- Increase participant engagement
- Enhance the meaning of research findings
- Initiate dialogue between the participants and other experts about issues concerning the particular research domain
- Explain the research to non-professionals
  - Enhances transparency and user trust

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Interactive Lecture/Tutorial

Data Storytelling Parts

- Data storytelling used to describe methods that use data (data science, big data..)
- Understanding the business, understanding the data, defining the purpose, understanding the audience, analyzing the data, modeling the story, interacting with the narrative, and continuous improvement
- **Actors:** audience, end users
- High interactivity
- **Plot:** Any events in the data story that underlines the main research
- **Conflicts:** Elements that lead to uncertainty about whether the goal will be achieved
- **Solutions:** Conclusions, future work

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Interactive Lecture/Tutorial

Interactive Exercise (15’ minutes)

- Work with your team members
- Think about a story plot to “advertise” your research topic and survey paper to non-professionals
- Identify the characters (actors), plot, conflicts, solutions
- You can either consider data storytelling parts or create any story plot that can be a plot for a video/movie/fiction story
- Will your story be applicable to different audiences?

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Interactive Lecture/Tutorial

References

- Segel, E. and Heer, J., 2010. Narrative visualization: Telling stories with data. IEEE transactions on visualization and computer graphics 16,6, 1139-1148.
- Finkler, W. and Leon, B., 2019. The power of storytelling and video: a visual rhetoric for science communication. Journal of science communication, 18(5), A02.
- Beauxis-Aussalet E, Behrisch M, Borgo R, et al. The Role of Interactive Visualization in Fostering Trust in AI[J]. IEEE Computer Graphics and Applications, 2021, 41 (6): 7-12. Gagnon

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