TOOLBOX OF DIGITAL TOOLS

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CONTENTS

This toolbox of recommended **digital tools** presents several resources that **support the teaching of applied and ethical AI**, and guides educators on how to implement the tools in the classroom.

INTRODUCTION

Overview

The Toolbox of Recommended Digital Tools is a collection of 13 digital tools to help business and management educators implement applied and ethical AI in presential, hybrid, and digital higher education classes. This guide presents users with tutorials for using the tools and examples for implementing them in the classroom. It is the third component integrated in the Responsible AI Case Studies and Introductory Toolkit created by the AI Leaders Project, and complements the State-of-the-Art Review, Compendium of Case Studies, and Guidelines on Implementing an AI Orientation Day.

Purpose

This toolbox of recommended digital tools presents several resources that support the teaching of applied and ethical AI, and guides educators on how to implement the tools in the classroom. The toolbox was developed with business and management educators in mind, but due to the nature of the tools, may be useful to educators outside of these fields. This toolbox supports the pedagogical upskilling of educators by making them aware of existing digital tools, and offering instructions and examples for utilizing the tools in the classroom. The resources included aid teachers in understanding the importance, relevance, and possibilities for integrating applied and ethical aspects of AI into their courses, and aim to further motivate them to implement these aspects in the future.

Acknowledgement

AI Leaders project is grateful to the AI experts who were consulted through the Case Study Interviews and other channels for their tool recommendations, many of which have been included in this toolkit.

User Guide

Tools have been sorted into three user categories based on AI knowledge and skill level. In each category, the tools can be used independently. Educators choose which tools are relevant for their classrooms/lessons based on the description and ethical criteria addressed. For each tool, tutorials for using the tool itself as well as examples for tailoring the tool to ethical and applied AI implementation in business and management education are provided. In some instances, the tools showcase how AI models do not meet key ethical criteria, while other tools are included because they help users and developers address ethical concerns in AI models.

NOTE

Users should be aware that the tools and tutorials are externally-created content. At the time of publication, all resources linked in this Toolbox are publicly available, but the AI Leaders Project cannot guarantee that they will remain so. Further, each tool and site operates under its own security and data privacy settings, and users should access the materials at their own risk and according to their own institution's policies.

Digital Tool Selection Process

*The following **digital tools were recommended from experts in the AI field** including professors, entrepreneurs, and business leaders.*

The AI Leaders project team further evaluated the tools based on accessibility, namely how easy each tool is to find and use, and whether it is cost-effective. If comparable tools were available, the consortium chose the tool which itself uses more responsible AI (for example, choosing Perplexity over ChatGPT). The tools were also selected to ensure that all ethical criteria defined by the consortium in the Responsible AI Case Studies and Introductory Toolkit are covered.

AI Leaders then sorted the tools into one of three categories based on user knowledge and skill level, as well as highlighted which ethical AI criteria each tool helps showcase or address.

Tool Structure - For each digital tool, users are presented with

01 A brief description

02 Link to the resource

03 Note on accessibility

04 Ethical criterium/criteria the tool addresses

05 Guidance for classroom implementation

06 Link(s) to user tutorial(s)

Where applicable, each tool is also connected with (one of) the expert(s) who recommended it for use in the classroom. The information included is meant to help users learn the basics about each tool and get ideas for using these AI tools in the classroom.

User Level

01.

Beginner

Bachelor level or elective interest - little to no expertise is required to understand and/or use these tools.

02.

Intermediate

Bachelor or Master level -some computer programming or technical expertise is required to understand and/or use these tools.

03.

Advanced

Master or other post-graduate level - a great deal of computer programming or AI-specific expertise is required to understand and/or use these tools.

Applied and Ethical AI Categories

Fairness:
reducing bias in AI algorithms to ensure outputs are impartial and representative

Accountability:
establishing clear responsibilities for AI outcomes and offering mechanisms for user feedback

Societal Impact:
facilitating improvements in efficiency, welfare, or other public benefits

Transparency and Explainability:
openly sharing and making understandable how the AI model functions and makes decisions

Regulatory Compliance:
complying with current laws and regulations related to AI usage (including general data protection regulation (GDPR))

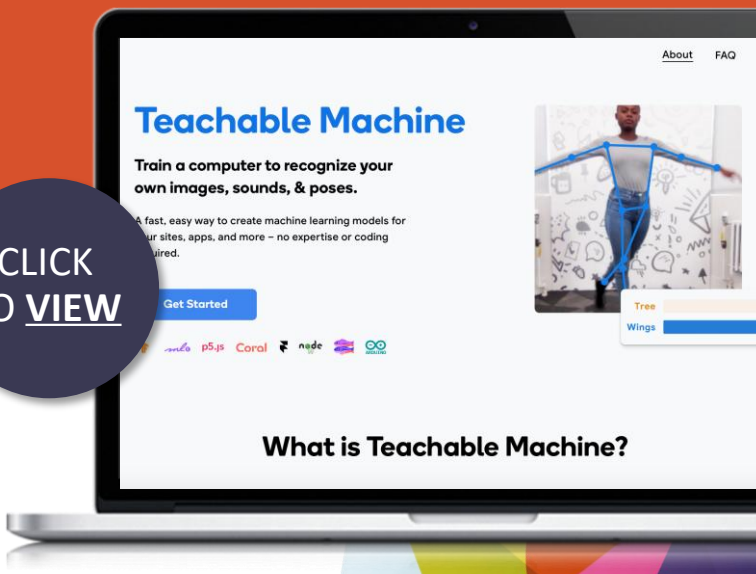
Beginner

01

Teachable Machines by Google

This simple tool allows users to create machine learning models. For example, users can train a computer to recognize and learn from specific images, sounds, or poses.

It is recommended for illustrating AI models' potential for fallacy. No previous AI skill or coding knowledge is needed to use this web-based tool.



CLICK TO **VIEW**

Note on Accessibility

Free to use, no account required. The equipment needed includes a modern browser and webcam.

Applied / Ethical AI

Fairness.

How to Implement in the Classroom

Engage in a discussion on whether or not AI is fair. Using Teachable Machine, demonstrate a biased model (by limiting input data). Discuss how the algorithm or dataset could be improved to create better results. Have students work in teams or individually to open Teachable Machines, choose a model type, and input their own data. Encourage them to change the input data to change the outputs

Case Study Connection

Sašo Karakatič uses this tool to teach students how AI can use data incorrectly.

Tutorials

- **The Coding Train – Teachable Machine 1: Image Classification**

  YouTube
  https://www.youtube.com/watch?v=kwcillcWOg0&list=PLRqwX-V7Uu6aJwX0rFP-7ccA6ivsPDsK5&index=3

- **Kimberlee Swisher – Teachable Machine Introduction, Step-By-Step**

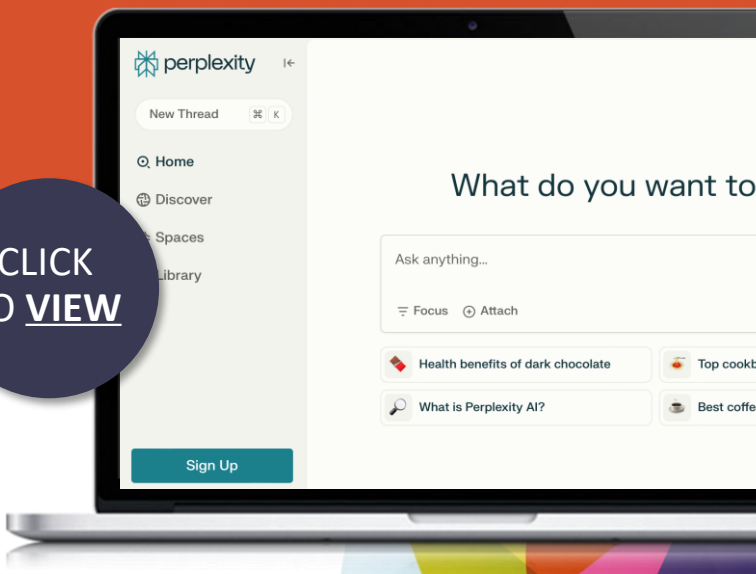
  YouTube
  https://www.youtube.com/watch?v=vPKNhB3msBQ

Beginner

02

Perplexity

This is an innovative AI-powered search engine designed to provide users with accurate, real-time answers to a wide range of questions. It combines the functionalities of traditional search engines with advanced conversational AI capabilities, making it a versatile tool for information discovery. *A comparable, alternative tool is ChatGPT.*



CLICK TO **VIEW**

Note on Accessibility

Free to use, no account required.

Applied / Ethical AI

Fairness, Transparency and Explainability, Regulatory Compliance

How to Implement in the Classroom

Incorporate real-time Q&A sessions with Perplexity to make lessons more engaging. For instance, pose questions during class discussions and have Perplexity provide immediate answers. Review the different sections of the answers together, and debate about the fairness of the sources provided. Alternatively, come up with a single question and have each student enter a variation of the question as a prompt in Perplexity to demonstrate the different output possibilities and the relation to fairness.

Case Study Connection

Damian Kędziora of Lahti University and the University of Warsaw uses ChatGPT

Tutorials

- **Jeff Su - Learn 80% of Perplexity in under 10 minutes! -**

  YouTube
  https://www.youtube.com/watch?v=YoWdogtZRw8

- **Corbin Brown – How to Use Perplexity AI for Beginners**

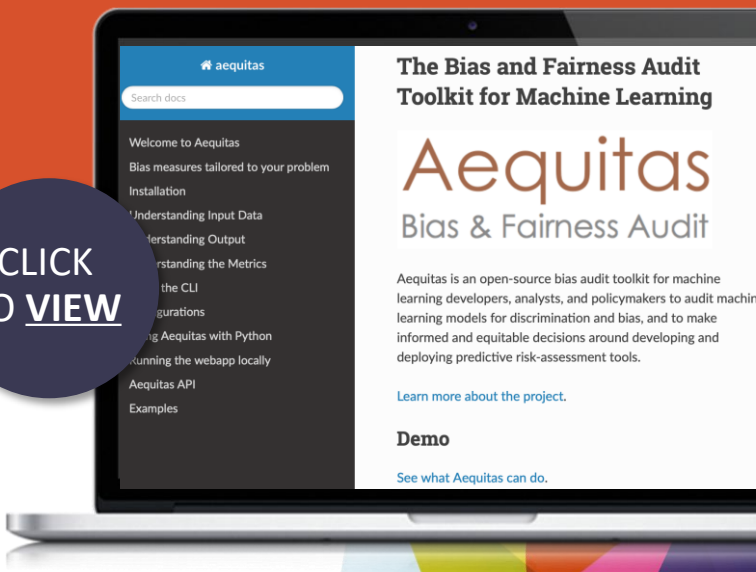
  YouTube
  https://www.youtube.com/watch?v=qpN-pjev-vM

Beginner

03

Aequitas

An open-source bias detection tool that calculates fairness metrics such as precision and recall for different demographic groups, helping ensure equitable model performance across different user segments.



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Note on Accessibility

No account is necessary. For the web platform, no coding is required; however, the dataset must be uploaded in CSV format. For the Python library, coding proficiency is required. Additionally, a fundamental understanding of statistics is essential.

Applied / Ethical AI

Fairness

How to Implement in the Classroom

Explain key concepts like fairness, bias, and why they matter in AI. Then, introduce Aequitas, its purpose, and how it works. Guide students through using Aequitas with sample datasets: Demonstrate both the web interface (no coding) and Python library (for coding practice).

Example of activity: Create groups. Present a case study to each group involving algorithmic bias. Have students present their findings from fairness audits and debate the ethical implications of their case.

Case Study Connection

Sérgio Jesus shares how Aequita, Feedzai's open-source bias-detection tool, can help educate clients and stakeholders on ways to better collect data for fair outputs.

Tutorials

- **Jeff Su - Learn 80% of Perplexity in under 10 minutes! -**

  YouTube
  https://www.youtube.com/watch?v=YoWdogtZRw8

- **Corbin Brown – How to Use Perplexity AI for Beginners**

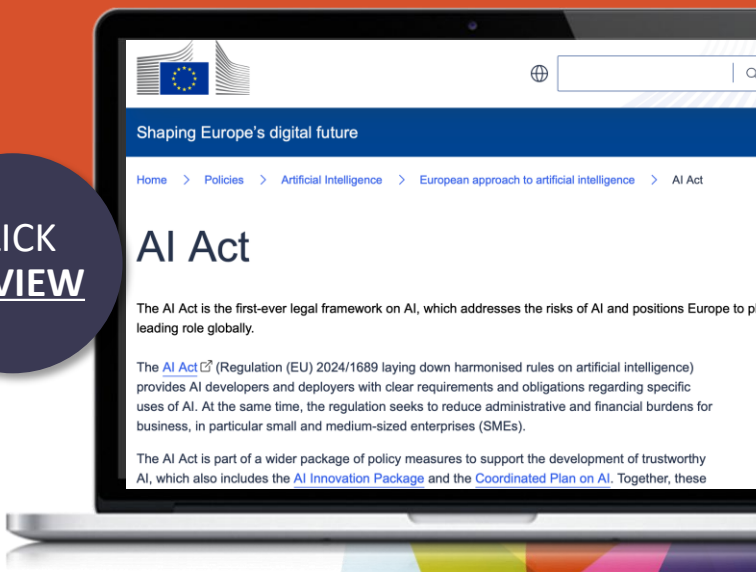
  YouTube
  https://www.youtube.com/watch?v=qpN-pjev-vM

Beginner

04

AI Act

A legal framework that addresses the risks of AI. It can be used by institutions to establish accountability structures and define internal AI policies.



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Note on Accessibility

The AI Act is a free to access and download framework.

Applied / Ethical AI

Accountability; Regulatory Compliance

How to Implement in the Classroom

Present students with a case study and prompt them to develop an AI system in teams. Teach the core principle of the AI Act (i.e. risk categorization or transparency, fairness, and data protection requirements). Have the students assess the risk of their AI system according to the AI Act and check whether their system complies with necessary safeguards. Finally, have the teams assess each other's AI systems for compliance.

Case Study Connection

Danny Bialek of the Digital Education Council uses the Digital Education Council AI Governance Framework to give policy guidance.

Tutorials

- **EU Artificial Intelligence Act – The AI Act Expolorer**

  https://artificialintelligenceact.eu/ai-act-explorer/

- **The Future Society – European AI Governance**

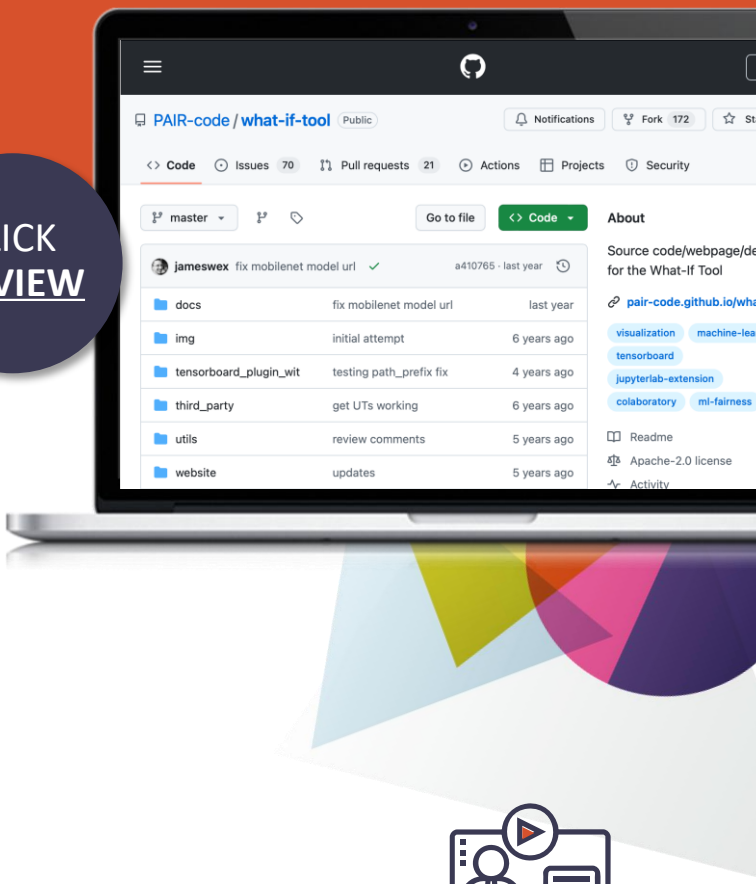
  https://thefuturesociety.org/theme/european-ai-governance/

Intermediate Level

05

What-If Tool (WIT)

A tool by Google for investigating model performance and fairness.



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Note on Accessibility

No account needed for local or Jupyter use. A Google account is required for Colab or TensorBoard. Coding and statistics proficiency are required.

Applied / Ethical AI

Transparency and Explainability; Fairness

How to Implement in the Classroom

Evaluate students based on their ability to use WIT to assess model fairness, explore "what-if" scenarios, and analyze the impact of various inputs on model behavior. Assign cases and have students present their findings, including any fairness issues discovered and potential solutions. Finally, assess students' understanding of the ethical implications of fairness and bias in AI.

Case Study Connection

Danny Bialek of the Digital Education Council uses the Digital Education Council AI Governance Framework to give policy guidance.

Read More

Wexler et al. (2019) describes the design of the tool, and reports on real-life usage at different organizations in the article "The What-If Tool Interactive Probing of Machine Learning Models."

Tutorials

- **Google Cloud Tech - Getting Started with the What-if Tool | Introducing the What-If Tool**

  https://www.youtube.com/watch?v=qTUUwfG1vSs

- **Google Cloud Tech - Using the What-if Tool Performance & Fairness features | Introducing the What-If Tool**

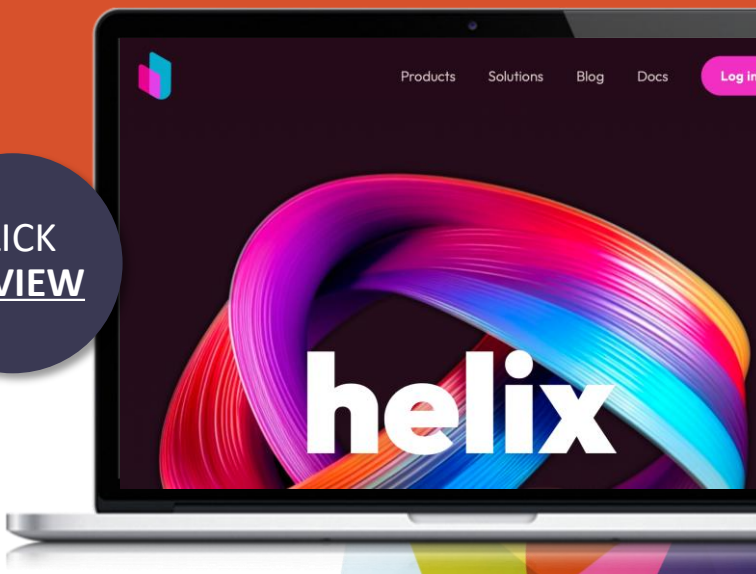
  https://www.youtube.com/watch?v=ReqwELaX23I

Intermediate Level

06

Helix.ml

An open-source platform for fine-tuning AI models and understanding how LLMs work.



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Note on Accessibility

Login with Google account or email address is required.

Applied / Ethical AI

Transparency and Explainability

How to Implement in the Classroom

Define knowledge sources that students can input into Helix.ml (i.e. news articles, social media posts, academic articles). Let students use AI to help them create their own content, whether it's in the form of reports, presentations, or videos. Either in groups or as independent projects, lead a discussion on the content output and in what ways it differs based on knowledge sources.

Case Study Connection

Nicolas Gimenez of Zkorum suggests this open-source platform to help explain how Large Language Models (LLMs) work.

Tutorials

- **Helix - Helix 1.0 Launch Demo**

  https://www.youtube.com/watch?v=6QcOXq3VFpc

- **Luke Marsden - Helix.ml launch demo**

  https://www.youtube.com/watch?v=v6XZT8u6khI

Intermediate Level

07

Jupyter Notebook

Tools recommended for teaching AI concepts through coding, enabling students to experiment with AI models through hands-on learning. For data science students, offers flexibility and powerful analytical capabilities for building and testing AI models. When installed locally, the data always remains in the personal computer, guaranteeing more privacy than cloud-based alternatives.

CLICK TO **VIEW**

Note on Accessibility

Not always possible to install locally on personal devices due to storage/complexity issues. Coding and statistics knowledge required.

Applied / Ethical AI

Transparency and Explainability; Fairness

How to Implement in the Classroom

Assign interactive exercises where students can solve equations or graph functions and visually explore mathematical concepts.

Case Study Connection

Artur Tim of the University of St. Gallen in Switzerland recommends this tool for AI model training.

Tutorials

- **Introduction to Jupyter Lab and Jupyter Notebooks**

  https://jupyter.org/try-jupyter/notebooks/?path=notebooks/Intro.ipynb

- **Corey Schafer - Jupyter Notebook Tutorial: Introduction, Setup, and Walkthrough**

  https://www.youtube.com/watch?v=HW29067qVWk

Intermediate Level

Google Colaboratory

08

Free, web-based, open-source tool for hands-on, practical experimentation with data sets, coding, and computations. Google Colaboratory (Colab) does not require local software installation. It is similar to Jupyter Notebook, but cloud-based.

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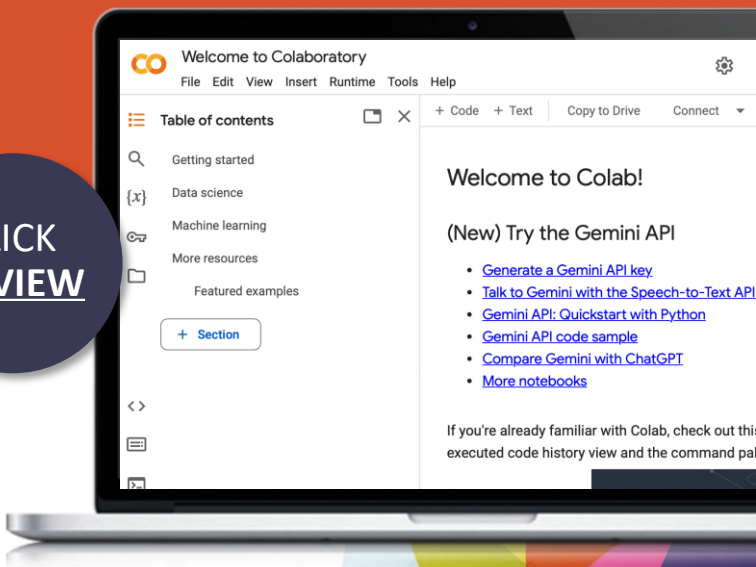


Note on Accessibility

It is web-based, meaning it can be accessed from virtually any device with an internet connection - including desktops, laptops, and tablets - without any local software installation. It is free to use. There are limitations to the code types that can be used via Google Colab (i.e. no crypto mining). The user needs a Google account to use it.

Applied / Ethical AI

Fairness; Transparency and Explainability

How to Implement in the Classroom

Use Colab to run practical exercises related to ethical AI. For example, students could use datasets to train models, evaluate them for bias, and explore techniques to mitigate fairness issues. They could also study how regulatory compliance and transparency play a role in AI development. Notebooks can also be used for homework assignments, where students are asked to complete tasks or answer theoretical questions directly in the notebook.

Case Study Connection

Jesper Valentin Holm recommends using Google Colab for teaching AI to new students through practical experimentation, noting that this tool's visualisation features help make more complex concepts accessible and engaging.

Tutorials

- **TensorFlow - Get started with Google Colaboratory**

  https://www.youtube.com/watch?v=inN8seMm7UI

- **Simplilearn - Google Colab Tutorial for Beginners**

  https://www.youtube.com/watch?v=8KeJZBZGtYo

Advanced Level

09

DALex

A programming library for teaching fairness and explainability. Helps users understand how decisions are made by AI models.

CLICK TO **VIEW**

Note on Accessibility

Understanding of machine learning concepts and Python programming is required. The program needs to be installed locally.

Applied / Ethical AI

Fairness, Transparency and Explainability

How to Implement in the Classroom

Develop project-based learning activities, where students work in teams to build and interpret machine learning models. Students can be tasked with not only optimizing their models for performance but also ensuring that the models are transparent. This approach encourages collaboration and hands-on learning, allowing students to apply DALex's tools to real-world problems

Case Study Connection

Lipovetsky, S. (2022) presents a valuable collection of methods for models' exploration and diagnostics for various machine learning algorithms (DALex in Chapter 3 https://www.tandfonline.com/doi/full/10.1080/00401706.2022.2091871.

Read More

Sašo Karakatič recommends DALex for teaching fairness and XAI.

Tutorials

- **DALex for Teaching**

  https://htmlpreview.github.io/?https://github.com/ModelOriented/DALEX-docs/blob/master/vignettes/DALEX_teaching.html

- **Przemyslaw Biecek - Explanatory Model Analysis podcast - DALEX for R - 02**

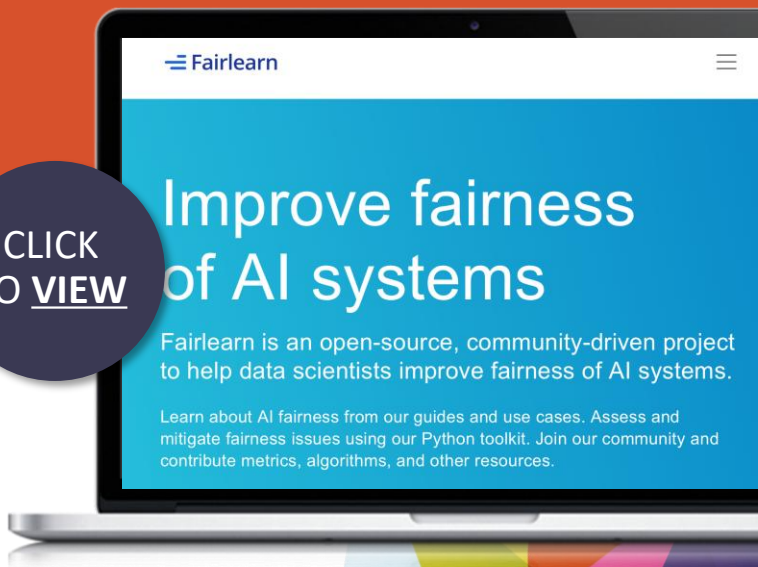
  https://www.youtube.com/watch?v=_znReP-5j0A

Advanced Level

FairLearn

10

It is an open-source, community-driven project to improve fairness of AI systems.



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Note on Accessibility

Free to access; however, users may need some prior experience with machine learning and Python programming.

Applied / Ethical AI

Fairness

How to Implement in the Classroom

Use real-world datasets (e.g., public datasets) to demonstrate how AI can perpetuate biases. By using FairLearn to examine these biases, students can gain insights into how AI systems impact different demographic groups and learn how to design more equitable solutions. After completing exercises with FairLearn, students should reflect on the ethical challenges in machine learning.

Educators can facilitate discussions about the societal implications of biased AI systems, the role of fairness in technology, and how to balance performance with ethical considerations. This can also be an opportunity to discuss legal and regulatory frameworks related to AI fairness.

Case Study Connection

Sašo Karakatič gives engineering students hands on experience with fairness in AI development.

Tutorials:

- **FairLearn User Guide**

  https://fairlearn.org/v0.11/user_guide/index.html

- **Microsoft Developer - How to Test Models for Fairness with Fairlearn Deep-Dive**

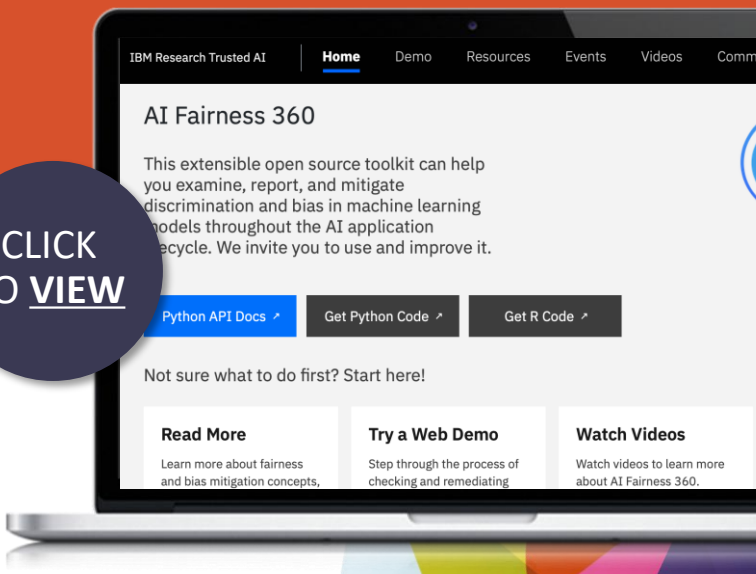
  https://www.youtube.com/watch?v=Ts6tB2p97ek

Advanced Level

IBM AI Fairness 360

11

An open source toolkit designed to detect, report, and mitigate bias in machine learning models.



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Note on Accessibility

Free resource that needs to be installed locally. Python and machine learning knowledge required.

Applied / Ethical AI

Fairness

How to Implement in the Classroom

Assign group projects to tackle fairness challenges using AIF360, where students can reflect on how bias in AI models affects different communities and discuss solutions.

Case Study Connection

Sašo Karakatič recommends using this tool to help detect bias.

Read More

Bellamy et al. (2018) present the case “AI Fairness 360: An Extensible Toolkit for Detecting, Understanding, and Mitigating Unwanted Algorithmic Bias”. https://arxiv.org/abs/1810.01943

Tutorials

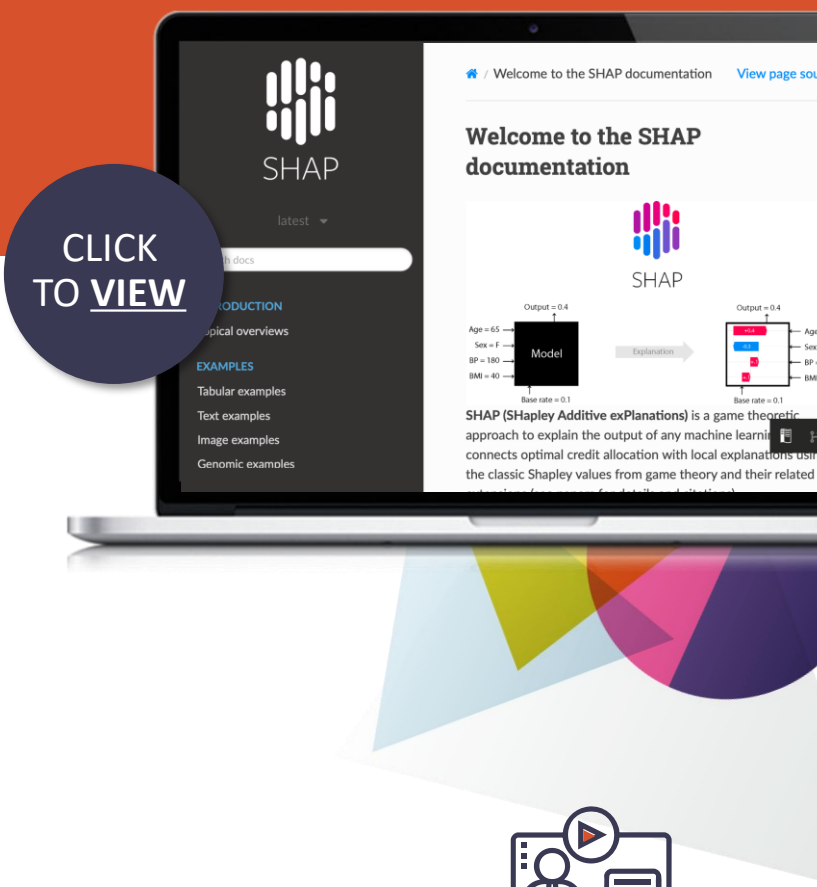
- **2 AI Fairness 360 - Videos**
  https://aif360.res.ibm.com/videos
- **Jenna Ritten - AI Fairness 360 Toolkit: Identify & Remove Bias From AI Models**
  https://www.youtube.com/watch?v=pEo8Vxtw5rg&list=PLHauDvxXosPHf2mSyhtnAhR4lADqtRQwf
- **Sisile Casie – Exploring IBM’s AI Fairness 360 Toolkit – AI Workflow: Feature Engineering and Bias Detection**
  https://www.youtube.com/watch?v=DBqRmvXwwUA

Advanced Level

SHAP

12

A library used to explain individual predictions of AI models using a game theoretic approach



Note on Accessibility

Foundational knowledge in machine learning and Python programming is required. It is free to use and can be installed locally from either PyPI or conda-forge.

Applied / Ethical AI

Transparency and Explainability; Fairness

How to Implement in the Classroom

Use SHAP to explain how complex models make decisions and how different features contribute to the final prediction. Present students with real-world case studies that involve high-stakes decision-making. After completing SHAP-based exercises, lead discussions about the ethical implications of explainability in AI.

Case Study Connection

André Morim of LTP Labs uses SHAP to involve more technically adept stakeholders in the development process of AI models.

Tutorials

- **2 An introduction to explainable AI with Shapley values**

  https://shap.readthedocs.io/en/latest/example_notebooks/overviews/An%20introduction%20to%20explainable%20AI%20with%20Shapley%20values.html

- **SHAP values for beginners** What they mean and their applications

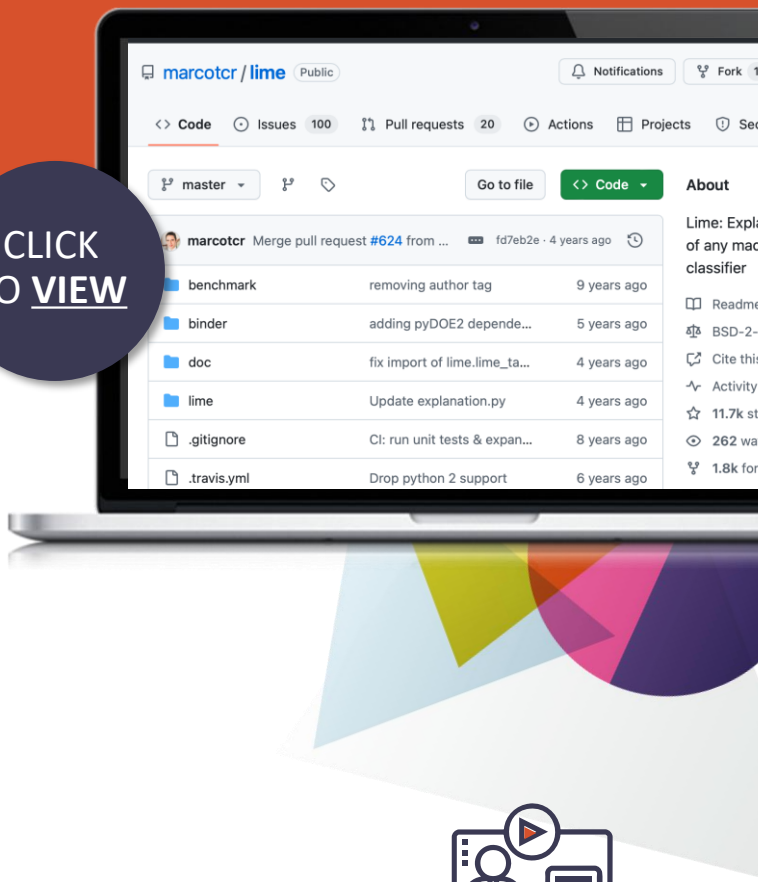
  https://www.youtube.com/watch?v=MQ6fFDwjuco

Advanced Level

LIME

13

A tool used to explain AI predictions, making models more interpretable.



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Note on Accessibility

LIME can be run in Python environments such as Jupyter Notebooks and Google Colab, allowing for easy interactive use. However, users need a basic understanding of machine learning concepts and Python programming to fully leverage the tool's potential.

Applied / Ethical AI

Transparency and Explainability

How to Implement in the Classroom

Ask students to analyze how sensitive features (such as gender, age, or race) impact model predictions using LIME's explanations. Students can learn how to detect and address potential fairness concerns by identifying whether certain features disproportionately influence outcomes, prompting discussions about how to mitigate bias in machine learning models.

Case Study Connection

André Morim of LTP Labs uses LIME to collaborate with technically and analytically proficient stakeholders in the development process of AI models.

Tutorials:

- **KDD2016 video - Introduction**

  https://www.youtube.com/watch?v=hUnRCxnydCc

- **Aleixnieto, Understanding LIME | Explainable AI**

  https://www.youtube.com/watch?v=CYl172IwqKs

Meet the AI Experts

Danny Bialek

President of the Digital Education Council based in **Singapore**.

Nicolas Gimenez

Co-founder and Chief Technology Officer of Zkorum in **France**, a start-up working to rehumanize and depolarize social media.

Jesper Valentin Holm

Chief Executive Office of Cobiro in **Denmark,** a company specializing in developing AI-driven solutions within the marketing technology sector.

Sérgio Jesus

Research Data Scientist at Feedzai in **Portugal**, an internationally-operating company that provides solutions for financial fraud detection.

Sašo Karakatič

Associate Professor of Computer Science at the University of Maribor in **Slovenia**.

Damian Kędziora

Associate Professor in Software Engineering at Lahti University of Technology in **Finland** and Adjunct Professor in the Department of Management of Society Network at Koźmiński University in **Poland.**

André Morim

Senior Consultant at LTPLabs in **Portugal**, a consulting firm providing services and solutions in AI and other quantitative methods.

Artur Tim

Ph.D. Candidate at the University of St. Gallen in **Switzerland** with previous experience working for BMW Research and Innovation Centre where he trained AI models.

Glossary of AI Terms

Algorithm: Procedure of steps or instructions a computer follows that can be used by machine learning systems to ingest data and make predictions.

Artificial Intelligence (AI): Simulation of human intelligence by machines or computers.

AI Ethics: Principles that govern AI's behavior in terms of human values.

Bias: Prejudiced results or outputs produced by algorithms or impartial data.

Big Data: Extremely large information sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.

Bounded input-bounded output (BIBO) stability: A system that indicates if every bounded input leads to a bounded output.

Chatbot: AI-powered tool intended to communicate in a conversational manner.

Copyleft: A form of licensing for Open-Source Code usage, ensuring a program, code, or other similar work, as well as subsequent versions or modifications, are free of cost. Helps ensure that AI systems remain open, transparent, and verifiable.

Cutoff date: The end date for an AI model's data input.

Data mining: Process of searching for patterns within a large set of data to extract specific information.

Data validation: Process of checking data quality before using it for AI models.

Deep learning: machine learning that imitates how humans learn new information.

Emergent Behavior (aka emergence): Unpredictable or unintended capabilities shown by AI systems

EU AI Act: Regulation for AI deployment within the European Union, focused on a risk-based approach to AI that classifies systems according to their potential impact on fundamental rights, including, among others, data privacy rights.

Fairness: Creation of algorithms and systems that make decisions impartially, equitably, and justly across all individuals and groups, especially those considered sensitive or protected, such as different ethnicities, genders, or disabilities.

Garbage in, garbage out (GIGO): Computer science concept that notes the quality of the output depends on the quality of the input.

General Data Protection Regulation (GDPR): European regulation that sets guidelines for the collection and processing of personal information from individuals who live in and outside of the European Union (EU).

Generative AI: AI technology that creates content from learned patterns in data.

Generative Pre-Trained Transformer (GPT): AI algorithm.

Guardrails: Rules or restrictions applied to AI models to direct data use.

Hyperparameter: Configuration variables that data scientists set ahead of time to manage the training process of a machine learning model.

Knowledge Engineering: AI field that tries to emulate (expert) human knowledge.

Large Language Model (LLM): AI algorithm that understands, summarizes, generates, and predicts new content.

Machine Learning: Use and development of computer systems that can learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data.

Moats: The ability for a product or company to maintain a competitive advantage and fend off competition to maintain profitability into the future.

Multimodal AI: Machine learning models capable of processing and integrating information from multiple modalities or types of data.

Natural Language Generation (NLG): Application of AI models to create written or spoken narratives that make sense to humans.

Glossary of AI Terms

Natural Language Processing (NLP): Branch of AI that enables computers to comprehend, generate, and manipulate human language.

Open Washing: When AI models are claimed to be open access but have user restrictions.

Optical Character Recognition (OCR): Technology that uses automated data extraction to quickly convert images of text into a machine-readable format.

Overfitting: Undesirable machine learning behavior that occurs when the machine learning model gives accurate predictions for training data but not for new data.

Parameter: A value that is used to control the operation of a function or that is used by a function to compute one or more outputs.

Pattern Recognition: Ability of machines to identify patterns in data, and then use those patterns to make decisions or predictions using computer algorithms.

Predictive AI: Use of machine learning to identify patterns in past events and make predictions about future events.

Prompt: Text or symbols used to represent the system's readiness to perform the next command.

Real-Time AI Feedback: Immediate responses or actionable insights provided by an artificial intelligence (AI) system based on live data inputs.

Structured Data: Defined and searchable data.

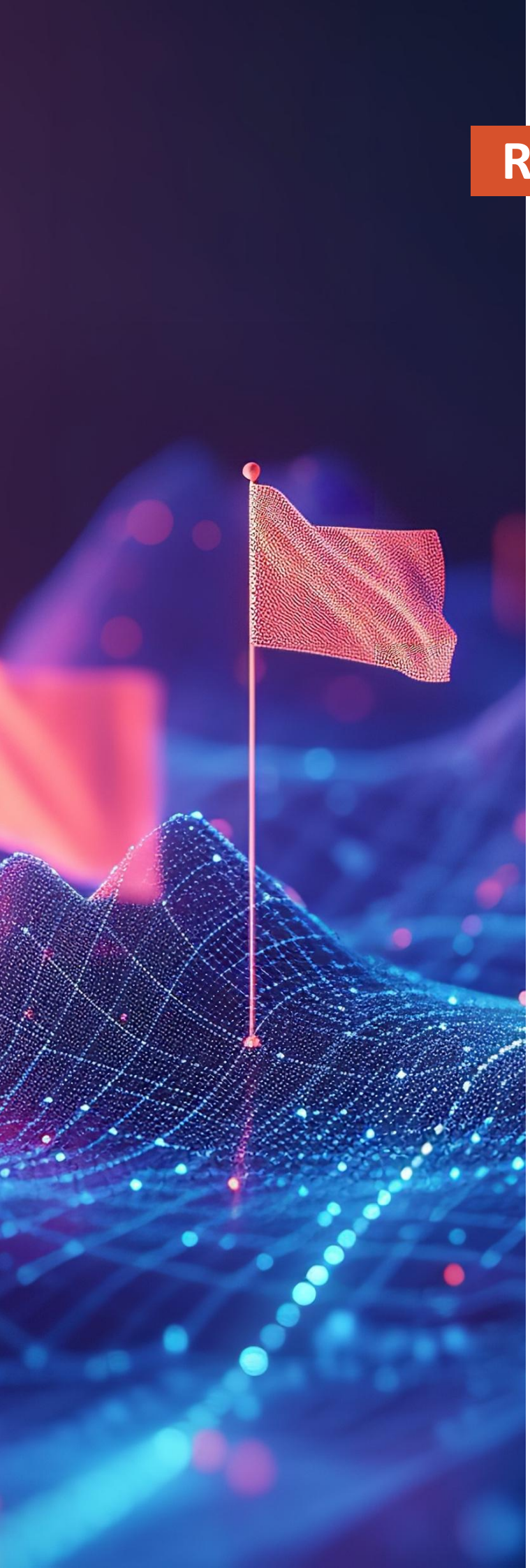
Synthetic Data: Artificial data that is generated from original data and a model that is trained to reproduce the characteristics and structure of the original data.

Training Data: Large dataset used to train machine learning (ML) models to process information and accurately predict outcomes.

Transfer Learning: Machine learning technique in which knowledge gained through one task or dataset is used to improve model performance on another related task and/or different dataset.

Unstructured Data: information that does not have a fixed format or structure that makes it difficult to organize and analyze.

Unsupervised Learning: A type of machine learning that learns from data without human supervision. Unlike supervised learning, unsupervised machine learning models are given unlabeled data and allowed to discover patterns and insights without any explicit guidance or instruction.



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