Certificate I: Understanding AI and Machine Learning in Africa

Course AIMLO1: Artificial Intelligence – Past, Present, and Future

Module 3: Example Applications

Lecture 3: AI Applications for the Web and Social Media

Learning Objectives

- 1. Identify the impact of AI and machine learning on web-based applications and social media
- 2. Explain the functionality of some representative applications
- 3. Discuss the technical and ethical challenges posed by the use of some of the underlying challenges.

Lecture Contents

- 1. Impact of AI on web applications and social media
- 2. Web search algorithms
- 3. Recommender systems
- 4. Face recognition
- 5. Lecture summary
- 6. Recommended reading & references

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Impact

- Al has had a major impact in a variety of applications and functionalities for the web
 - Search algorithms
 - Music and video recommendations
 - Automatic translation
- and for social media
 - News selection and recommendation
 - Sentiment analysis
 - Face recognition

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This progress is resulting in clear benefits to people and society



It also carries important ethical considerations and risks

Search Algorithms

Google's first algorithm was PageRank 👡

Based on standard mathematical methods

Augmented over the years by a collection of search tools

- Panda (2011)
- Penguin (2012)
- Hummingbird (2013)
- Pigeon (2014)

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Search Algorithms

Google's RankBrain (2016)

- An AI system that uses machine learning to infer how pages are related to concepts
- This means it can return relevant pages
- Even if they don't contain the exact words used in a search

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Search Algorithms

BERT (Bidirectional Encoder Representations from Transformer)

- A type of deep neural network for natural language processing

We met Transformer neural networks very briefly in Lecture AIML01-02-02

- BERT uses word context to find more semantically-relevant information
- This allows it to select 'featured snippets' (text, figures, tables) that appear at the top of Google's search results
- To provide definitions of the searched-for item

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Recommender Systems

- Recommendations for purchases in e-commerce sites
- Suggestions of related news and friends in social media
- Recommendations in media streaming sites and apps

80% of movies watched on **Netflix** are based on AI recommendations (Zhang et al. 2019).

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Recommender Systems

- Deep machine learning has become the default algorithm for the latest recommendation systems
- This raises important concerns
 - Some are technical, such as the need for explainability
 - For back-box deep neural networks to provide an explanation of the reasons for the recommendation

Recommender Systems

- Deep machine learning has become the default algorithm for the latest recommendation systems
- This raises important concerns
 - Others are ethical, concerned with the influence of these algorithms
 - In politics: introducing bias into recommendations and social media content during elections
 - In public health: undermining scientifically-grounded health advice
 - In the generation and diffusion of fake information, generally

- Al techniques for face recognition have become widespread on the web and on social media
- Image matching and people recognition
 - For example, in social media photo tagging
- Authentication
 - For example, to implement secure access in some smartphone systems

A variety of AI and machine learning algorithms have been developed to implement face recognition (Guo & Zhang 2019)

- Probabilistic Bayesian networks
- Support vector machines
- Deep learning face recognition systems
 - Convolutional neural networks (CNNs)
 - Autoencoders

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The pipeline of a typical automated face recognition system



Source: (Guo & Zhang 2019)

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Algorithms based on learning from datasets have important ethical implications regarding possible bias in the data used for the training

- Leading face recognition systems produced substantial disparities in the accuracy of gender classification (Buolamwini and Gebru, 2018)
 - Error rates of up to 34.7% in the classification of darker-skinned females
 - Error rates of 0.8% for lighter-skinned males
- Need to address and remedy implicit bias in such systems
- Need to make sure they are based on fair, transparent, and accountable analysis algorithms

Lecture Summary

- 1. Al and machine learning algorithms appear in many applications on the web and in social media, bringing great benefits but also technical and ethical challenges to ensure their operation is fair, transparent, and free of bias
- 2. Search algorithms have improved greatly as a result of the use of AI and machine learning, allowing the search algorithms to infer the intent of the search, beyond what is stated explicitly in the query by using context and inferring concepts
- 3. Recommender systems based on deep learning are very widely used but this also raises the possibility of their misuse and the need for these systems to be able to explain the basis of the recommendations.
- 4. Face recognition functionality is also widely used and, again, this raises the need for ethical deployment, ensuring the absence of bias, fairness, and transparency

Recommended Reading

Guo, G., & Zhang, N. (2019). A survey on deep learning based face recognition. Computer Vision and Image Understanding, 189, 102805. https://dl.acm.org/doi/abs/10.1016/j.cviu.2019.102805

Zhang, S., Yao, L., Sun, A., & Tay, Y. (2019). Deep learning based recommender system: A survey and new perspectives. ACM Computing Surveys (CSUR), 52(1), 1-38.

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Buolamwini, J., & Gebru, T. (2018). Gender shades: Intersectional accuracy disparities in commercial gender classification. In Conference on fairness, accountability and transparency (pp. 77-91). Proceedings of Machine Learning Research 81:1–15.

https://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf

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