From Pixels to Patterns and Apparels: AI Shaping the Future of Fashion

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IARIA

Introduction

- **Why fashion and why African fashion?**
- Numerous fashion AI applications are available (e.g., garment recognition, assisting designers in the creative process, customer recommendations, virtual try-ons etc.)
- Fashion datasets are used for benchmarking
- African fashion is in the spotlight thanks to social media and e-commerce web sites
- It is a 31bn dollar industry (2nd economic sector after agriculture) with international impact, $15.5bn worth of exports annually but still 1.2% of the global fashion market [African Business, Jan. 2024]
- Diversity of fashion datasets is limited - Ethical AI

Motivation

Fashion Datasets

Label	Description	Examples
0	T-Shirt/Top	
1	Trouser	
2	Pullover	
3	Dress	
4	Coat	
5	Sandals	
6	Shirt	
7	Sneaker	
8	Bag	
9	Ankle boots	
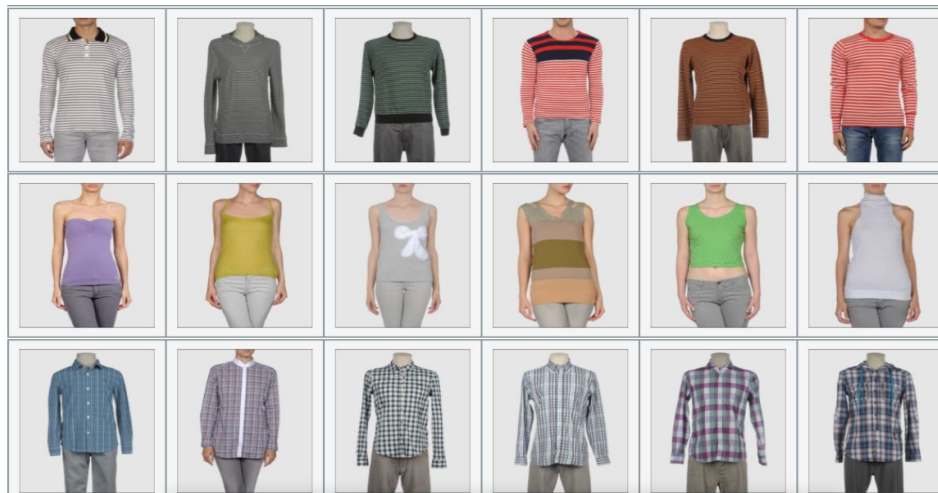
Fashion-MNIST [Xiao, Rasul, Vollgraf, Zalando Research, 2017] 70 000, 10 categories

DeepFashion [Pirker, Haltmeier, Tuinhof, 2018] 800 000 images, 50 categories

How would Fashion MNIST and DeepFashion classify these apparels ?
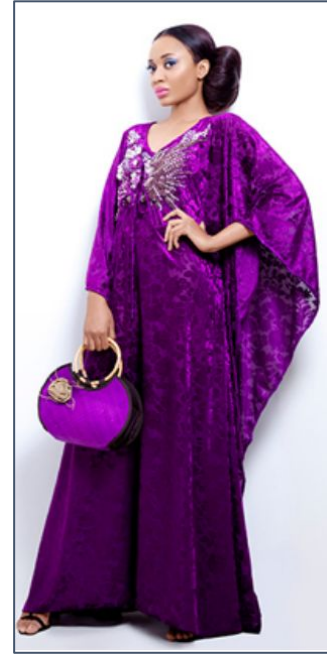
All datasets are biased

Creating Datasets

- The **World Economic Forum** recommends all entities to document the provenance, creation process, and possible uses of the datasets [World Economic Forum 2018]

- The authors of **Datasheets for Datasets** emphasize the importance of providing information about the motivation, composition, collection process (preprocessing, cleaning, labeling), recommended uses, distribution, and maintenance of the data [Gebru et al, 2021]

Addressing non-western centric problems and discussing AI ethics debates

Ethical Debates

- We will use African fashion and present **2 use cases** to elaborate on AI Ethics
- This work intersects **2 vigorous theoretical debates** in contemporary AI ethics
- It elaborate on the **ethics of inclusion**, while also contributing to current debates about how **inclusion** differs from ethical **fairness**
- It engages with the ethical debate on whether AI innovation should be slowed to prevent ethical imbalances or accelerated to solve them (**precaution versus acceleration in AI ethics**)

Collaborative work with Dr. Brusseau, Philosophy, Pace University, USA, and Computer Science, University of Trento, Italy

Fairness & Inclusion

- There is a tension between the ethical principles of **Fairness** and **Inclusion**
    - Example: A coin flip is fair (both participants get equal chance), but not inclusive (one side gets the entire reward)
- **Fairness** is about the process: both sides are treated equally [African theories and Aristotle]
- **Inclusion** is about the outcome: no one left behind [Theory of Justice, Rawls, 1971]

Use Case 1: Classification of African Fashion

Classification of Senegalese Fashion

- **Research questions:**
  - How can we have diversity in classification of fashion items?
  - How to classify Senegalese fashion?

- **Methodology:** Creation of a small dataset of boubous and taille mames (African / Senegalese fashion); classification using different models; transfer learning; MobileNetV2; involvement of SMEs

- **Publication:** Seck, A., LNU, K., Bathula, K. M. & Scharff, C. Senegalese Fashion Apparel Classification System using Deep Learning. RII 2022, Springer Cham, Lecture Notes in Complexity, March 2023

Boubou   Taille Mame

Src: https://www.pinterest.com/wwwaidaramareme058
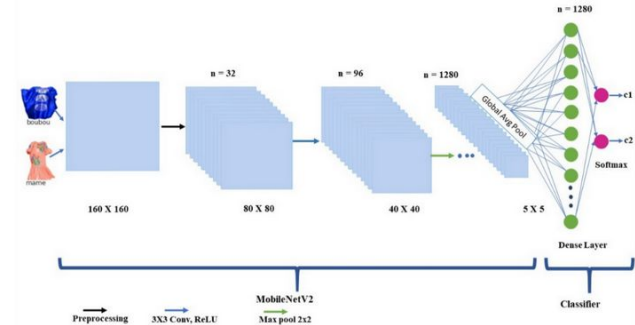https://kehindeoluleye.wordpress.com/2013/07/01/hot-didi-creati
ons-boubou-collection/

Use Case 2: Generation of African wax patterns

The Little Black Dress

The little black dress reimaginl

Wax Fabric

Wax

International Context

Generating African Wax Textile Patterns with StyleGAN and Stable Diffusion

- **Research questions:**
  - How to use Generative AI outside of the Western context?
  - How can different training approaches manipulate design aspects like color, pattern, and texture to generate African Wax patterns?
- **Methodology:** Synthetic 1k, 2k and 5k-image datasets from DALLE; StyleGAN (Generative Adversarial Network); Stable Diffusion; work with SMEs
- **Publication:** Towards AI-Generated African Textile Patterns. Christelle Scharff, Samyak Meshram, Krishna Mohan Bathula, Kaleemunnisa, Om Gaikhe, AISyS 2024.

StyleGAN2   Stable Diffusion
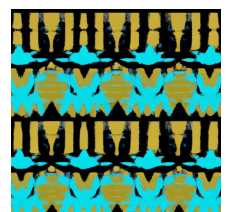
Feedback from (4) African Designers

Question	Response
1. What is their first impression?	Unanimously satisfied with the patterns they discovered
2. What general feedback did they have?	Missing symmetry and repetition, arrangements of the shapes, and lack of crispness and clarity in the design
3. Do the patterns look like Wax?	They really look like wax patterns with diversity in colors and thought that some patterns could be used by designers on the artistic side
4. What anomalies can they identify?	Symmetry
5. What use of the wax patterns did they see?	Apparels, clothing and fashion items
6. What was their favorite wax patterns? Why?	Green pattern selected by most SMEs

From pixels to accessories
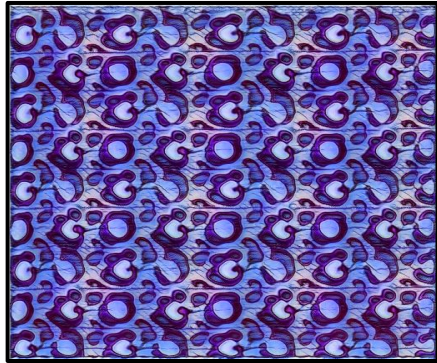
Printed African wax design - StyleGAN2-ADA

Bags designed with printed pattern

Ethical Debates

Inclusion in African Fashion

- The inclusion case for bringing African datasets and tools is clear

- Inclusiveness begins by conceiving a desirable outcome, which could be equal access to AI datasets and tools in fashion across the world

- Because the imperative is to leave no person – or region – behind, the ethical principle directly justifies the work we did in pioneering these datasets and tools for African fashion

Fairness in African Fashion

- There are comparatively few datasets and tuned AI tools for use in African fashion, when compared with Western fashion. **Is this imbalance fair?**
- **From one perspective,** it is unfair because African fashion designers interested in AI have fewer opportunities than their Western counterparts
- **From another perspective,** however, the difference can be explained as a natural result of equal opportunity: AI works anywhere in the world, and the fact that it is working better in one region than another does not mean that it is unfair, only that some regions exploit equal opportunities better than others.
- **In conclusion,** the fairness case for bringing African datasets to AI is blurry. Because of the focus on equality of outcomes and because those outcomes are currently imbalanced, the ethics of inclusion forms an ethical imperative to channel AI resources toward Africa in ways consonant with the research presented

Precaution & Acceleration in AI Ethics

- AI innovation – like all technical innovation historically – has yielded **benefits** and **harms**
- There is a debate about how to manage harms.
- **On the precautionary side**, there is the argument that AI innovation should be slowed in order to fully identify and resolve oncoming harms.
- **On the acceleration side,** there is the argument that AI innovation should be accelerated to directly resolve the problems that innovation has caused.

[Phillips et al 2024, Brusseau 2022 & 2023, Strickland 2022]

Precaution & Acceleration in AI Ethics for African Fashion

- In our case, one social harm is the **global imbalance** in the application of AI tools and availability of data in African fashion
- Should the use of AI in fashion be slowed to let applications and datasets spread globally, or, should the same tools be refined and advanced to apply to the African cases?
- Should innovation be slowed so that problems can be solved, or, should innovation be accelerated so that innovation solves innovation's own problems?
- Our research shows is that there is **no need to slow AI** to manage social harms that the technology causes. Instead, speeding the advance best serves broad social welfare and the ideal of inclusion

Conclusion & Future Work

- This research contributes to inclusive AI both technologically and ethically
- **Technologically,** datasets and applications are produced and tested for sub-saharan fashion
- **Ethically**, inclusion is defined and elaborated as humanist support for the technical research. Acceleration ethics is also elaborated and deployed to support the strategy for inclusion implemented in this research.
- Future work includes a more thorough qualitative evaluation of the generated patterns by SMEs and more work on how to refine styles - geometry, symmetry, symbols etc.

Thanks to my collaborators

Dr. James Brusseau [2], Dr. Krishna Mohan Bathula [1], Dr. FNU Kaleemunnisa [1], Samyak Rakesh Meshram [1], Om Gaikhe [1], Audrey Louie [1]

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