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Faculty of Engineering,
Built Environment and
Information Technology

Fakulteit Ingenieurswese, Bou-omgewing en
Inligtingtegnologie / Lefapha la Boetšenere,
Tikologo ya Kago le Theknolotši ya Tshedimošo

AI and the future of work

Make today matter

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@vukosi

Overview

What dreams may come

- 4th Industrial Revolution
- Artificial Intelligence/Machine Learning
- Data Science

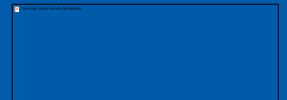
Living the dream

- Effect on Society
- Jobs, Jobs, Jobs

A bit about myself & research work



What Dreams May Come



The Dream

Futurism and Me

We always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten. Don't let yourself be lulled into inaction.- Bill Gates



ROADS?



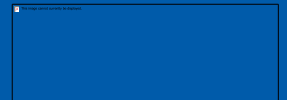
WHERE WE'RE GOING,
WE DON'T NEED ROADS.

DON'T PANIC

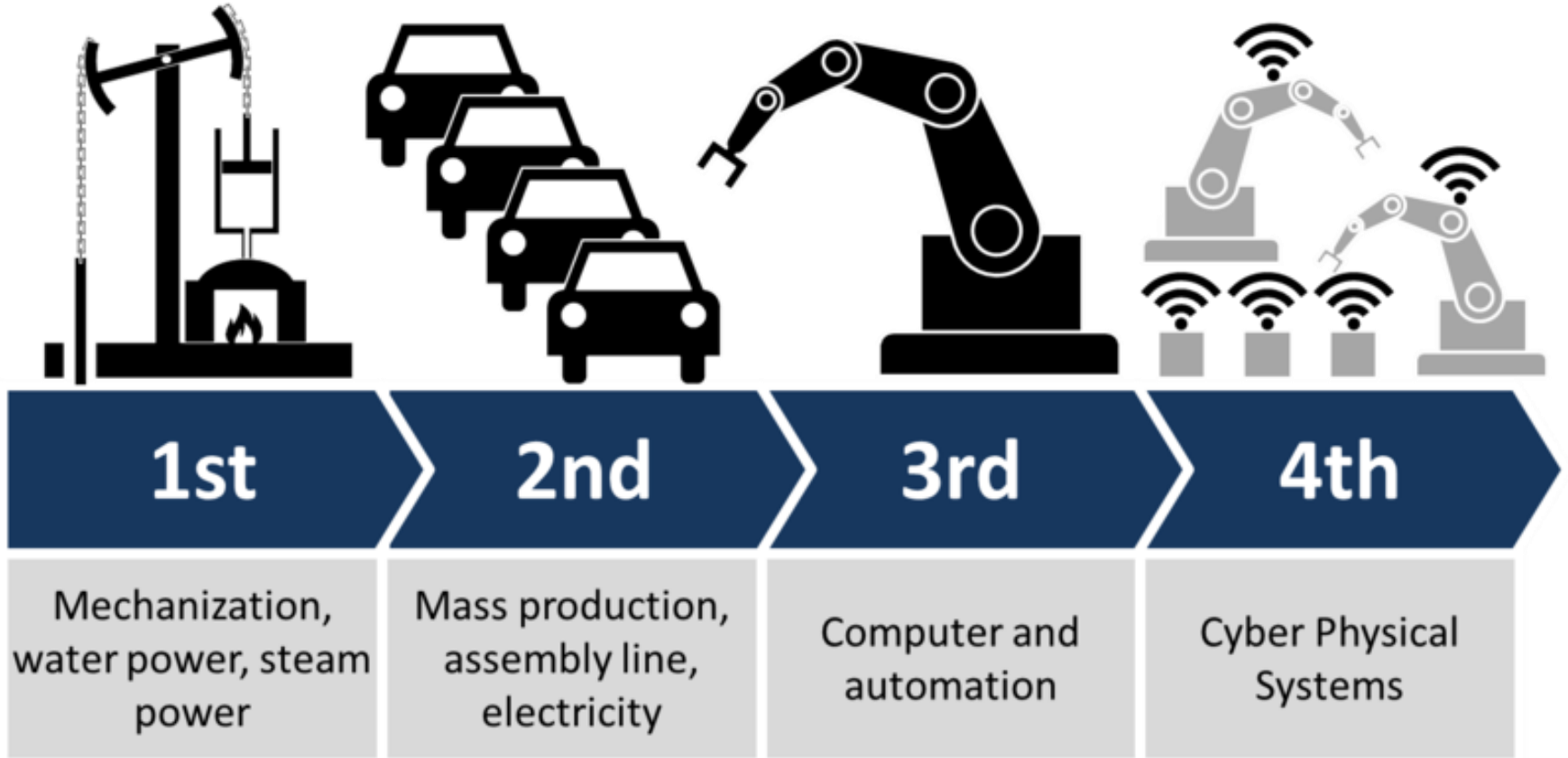


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The 4th Industrial Revolution



The 4th Industrial Revolution



Source: The 4 Industrial Revolutions (by Christoph Roser at AllAboutLean.com)



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4IR: Emerging Technologies

Robotics

Artificial Intelligence

Nanotechnology

Quantum Computing

Biotechnology

The Internet of Things (IoT)

3D printing

Autonomous vehicles.



Emerging Technologies

Robotics

Artificial Intelligence

Nanotechnology

Quantum Computing

Biotechnology

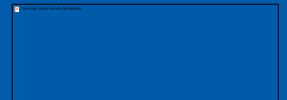
The Internet of Things (IoT)

3D printing

Autonomous vehicles.



Artificial Intelligence and Machine Learning



What is Artificial Intelligence?

Classical definition

An ***Agent*** (machine)

Exists in some ***Environment***

Takes ***Action***

To achieve some

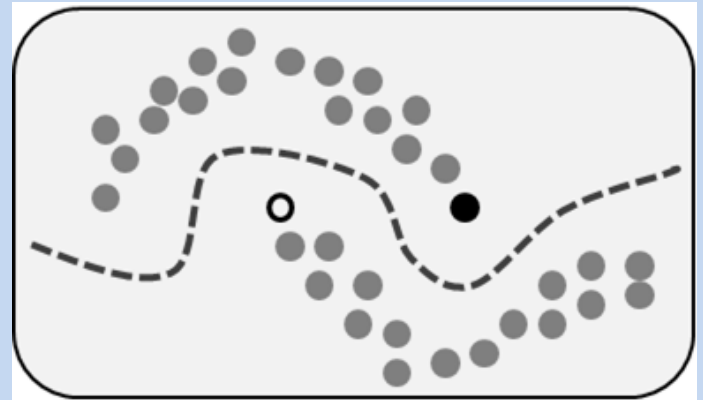
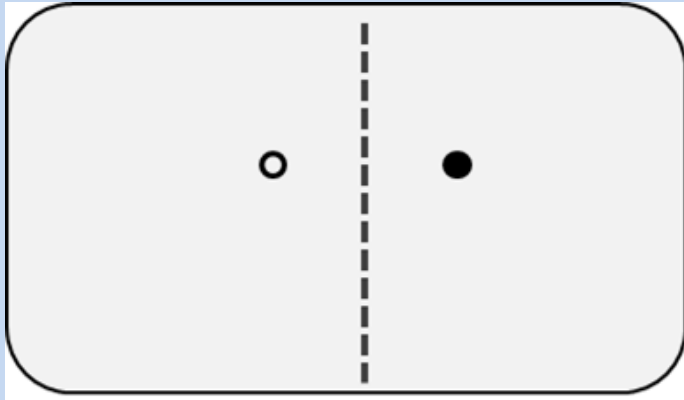
Goal(s)



What is Machine Learning?

Subset of **AI** that deals with

A machine ***learning*** patterns from data



Everyday AI/ML in our lives

Social Networks

Search Engines

Mapping

Chat systems

Logistics (Uber, Taxify etc.)

Entertainment (personalisation)



Everyday AI/ML in our lives

All these technologies augment our lives, affecting society



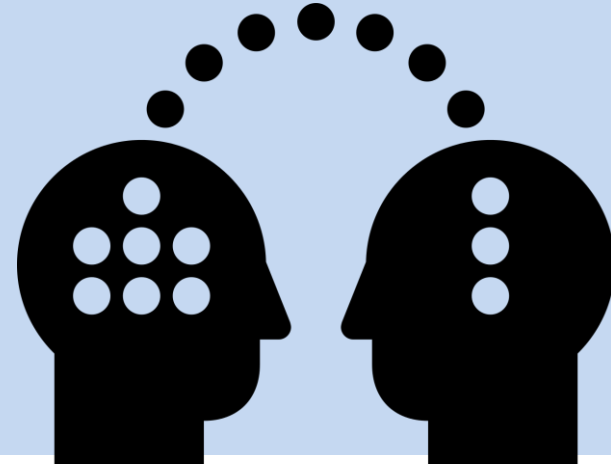
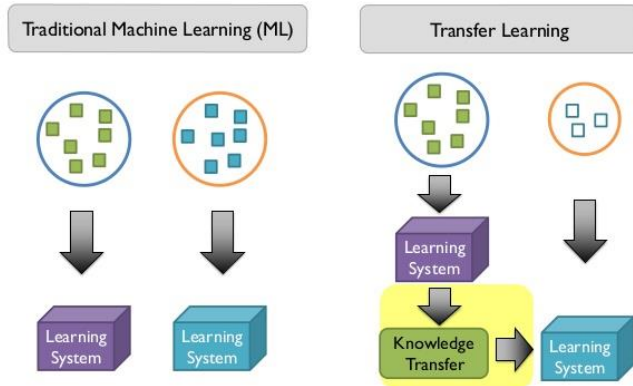
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What Dreams May Come: Future of AI

Problem Understanding

- Pattern matching one problem to another
- More databases of problems with solutions are available.

Transfer Learning

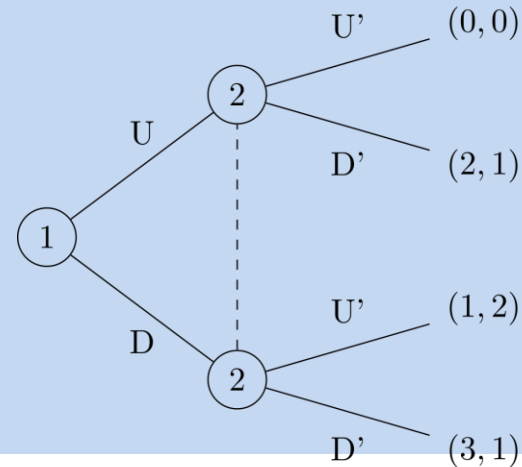
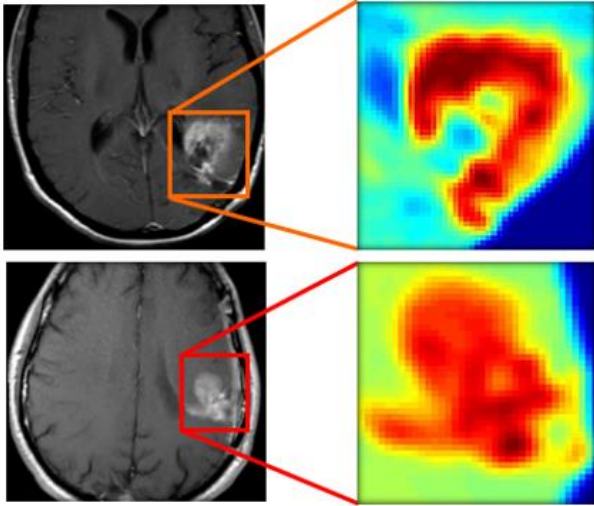


What Dreams May Come: Future of AI

Dealing with predicting the future

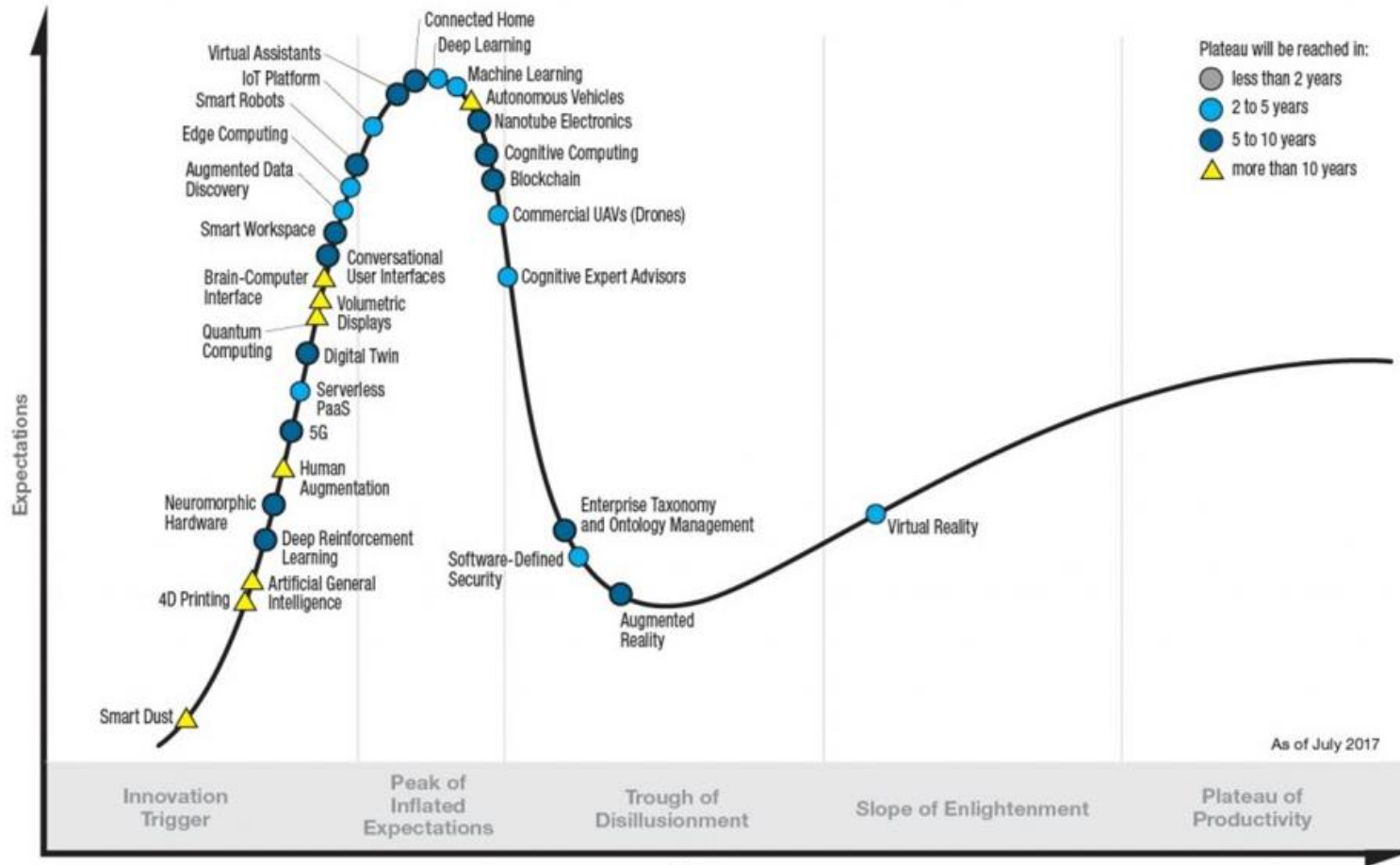
- Healthcare (dealing with chronic disease)
- Long term planning (dealing with uncertainty, multiple steps)

DIAGNOSTICS



What Dreams May Come: Future of AI

Gartner Hype Cycle for Emerging Technologies, 2017



What Dreams May Come: Future of AI

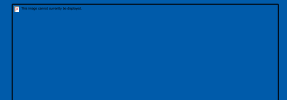
AI Winter: From Wikipedia

There were two major winters in 1974–80 and 1987–93^[6] and several smaller episodes, including:

- 1966: the failure of [machine translation](#),
- 1970: the abandonment of [connectionism](#),
- 1971–75: [DARPA](#)'s frustration with the [Speech Understanding Research](#) program at [Carnegie Mellon University](#),
- 1973: the large decrease in AI research in the United Kingdom in response to the [Lighthill report](#),
- 1973–74: [DARPA](#)'s cutbacks to academic AI research in general,
- 1987: the collapse of the [Lisp machine](#) market,
- 1988: the cancellation of new spending on AI by the [Strategic Computing Initiative](#),
- 1993: [expert systems](#) slowly reaching the bottom, and
- 1990s: the quiet disappearance of the [fifth-generation computer](#) project's original goals.



Effect on Society



Not Covering

SALON

NEWS

POLITICS

ENTERTAINMENT

LIFE

BUSINESS

SATURDAY, MAY 14, 2016 08:00 PM SAST

Fear our new robot overlords: This is why you need to take artificial intelligence seriously

Killer computers determined to kill us? Nope. Forget "Terminator" -- there's something more specific to worry about

PHIL TORRES

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TOPICS: ARTIFICIAL INTELLIGENCE, EDITOR'S PICKS, ROBOTS, STEPHEN HAWKING, INNOVATION NEWS, TECHNOLOGY NEWS



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Living the Dream: AI and Jobs

How are we planning for transitions?

- Country priorities = opportunities for retraining

How are we training our next generation?

- Critical Thinking
- Computational Thinking

Is our **SOCIETY** ready?

- Legal System, Social Implications, Inequality etc.?



Living the Dream: Societal Consequence

Two DUI Arrests

GREGORY LUGO	MALLORY WILLIAMS
Prior Offenses 3 DUIs, 1 battery	Prior Offenses 2 misdemeanors
Subsequent Offenses 1 domestic violence battery	Subsequent Offenses None
LOW RISK 1	MEDIUM RISK 6

Who is affected by false positives and false negatives?

Prediction Fails Differently for Black Defendants

	WHITE	AFRICAN AMERICAN
Labeled Higher Risk, But Didn't Re-Offend	23.5%	44.9%
Labeled Lower Risk, Yet Did Re-Offend	47.7%	28.0%

Who is responsible for decisions made using such systems?

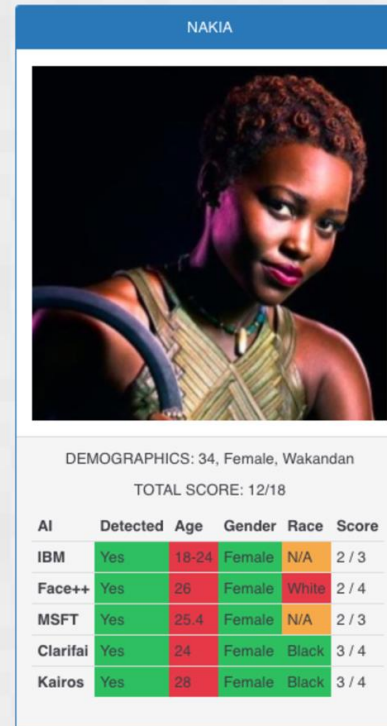
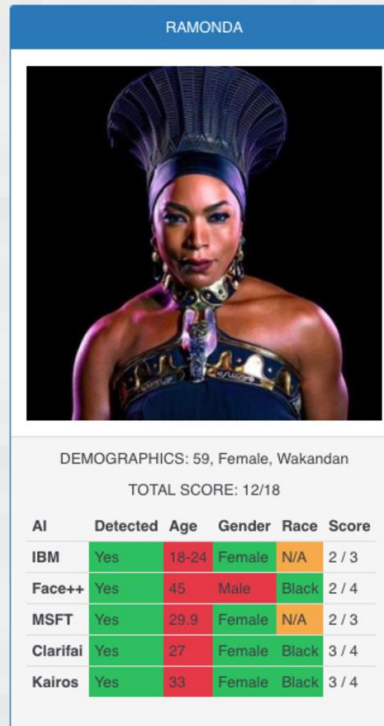
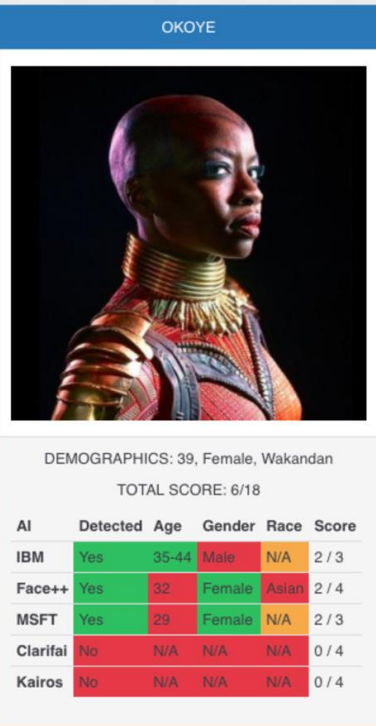
Response: Racial and Gender bias in Amazon Rekognition — Commercial AI System for Analyzing Faces.



Joy Buolamwini

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Jan 25 · 15 min read



Living the Dream: AI and Jobs

Some tasks are hard for humans to do, and easy for machines to do.

There are jobs that are easy for humans to do, but hard for machines to.

There are jobs that are easy for humans to do, and even easier for machines.



Living the Dream: AI and Jobs Manufacturing

Some tasks are hard for humans to do, and easy for machines to do.

Tool Making

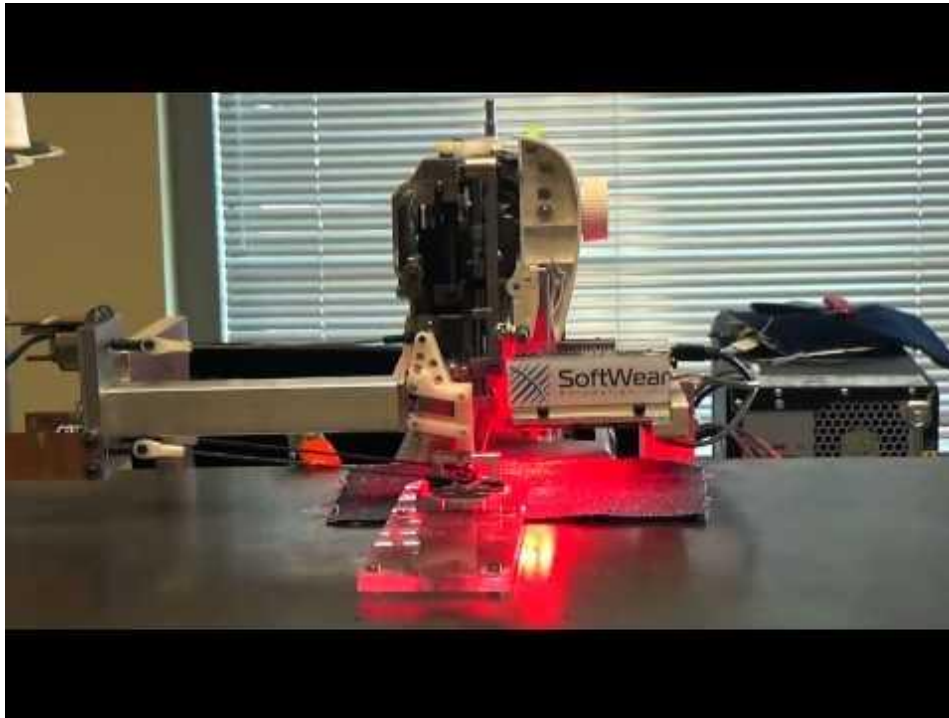
There are jobs that are easy for humans to do, but hard for machines to.

Sewing Material

There are jobs that are easy for humans to do, and even easier for machines.

Accounting

Living the Dream: AI and Jobs Manufacturing Sewing Material



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Living the Dream: AI and Jobs

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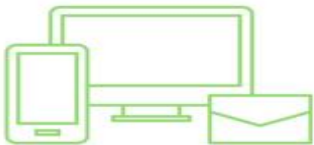
Debt Collection, Reimagined

Improve recovery rates and reduce compliance risk while giving your customers the best user experience possible.

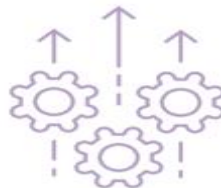
[Get Started](#)

Received an email and not sure if it is real? Read more about email authenticity on our [blog](#).

Using behavioral analytics, machine learning and modern communication channels our platform provides:



Real-time
communication



Superior Results



Customer Retention



Better Control

Living the Dream: AI and Jobs

[Quill™](#)[Solutions](#)[Partners](#)[Resources](#)[REQUEST A DEMO](#)

Goodbye static statements, hello custom narratives.

Customers desire relevant information, but generic statements and static visualizations aren't doing the trick, which compromises your ability to acquire new customers and maintain customer loyalty.

Personalized Communications

Quill intelligently conveys information that is important to each individual customer at unlimited scale, increasing customer satisfaction and reducing churn.

[VIEW A SAMPLE](#)

 Wealth Advisors, Ltd.

Dear Kaitlin,

Good news about your retirement investments. Since last quarter, your retirement account has grown. Your balance increased 2.7% to \$43,898 at the end of September. You're also up 3.2% for the year. You're still on track for retirement. We're watching your portfolio and by our calculations, you're on track to reach your goal of \$300,000 for retirement in 30 years. To assist you in staying on track, we have digital



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Living the Dream: AI and Jobs

Show and Scan!



answergarden.ch/893735



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Living the Dream: AI and Jobs

It's Not All Gloomy


Humanity has a crazy knack to Adapt

Machines + Humans


Humans + Machines

New Avenues



 Flight info · Updated 9 mins ago

South African Airways SA 265

MUC  JNB

ON-TIME Arrives in 2 hr 58 min

Depart · Munich Airport

Sat 10 Sep	Gate	Terminal
21:01	—	2
Scheduled at 21:05		

Arrive · O. R. Tambo International Airport

Today	Gate	Terminal
07:34	—	A
Scheduled at 07:40		

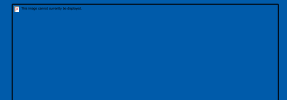
Living the Dream: AI and Jobs

Computational Thinking

*"Computational Thinking is the **thought process** involved in **formulating a problem** and **expressing its solution(s)** in **such a way that a computer**—human or machine—**can effectively carry out.**"* - Jeannette Wing



Research & Readiness



Skills Development & Community Building

University Programs (UP MIT Big Data Science)

DSIDE Vacation Training (CSIR)

Engagement with faculty to build Data Science across country.

Deep Learning Indaba

Aims to be flagship Machine Learning teaching conference on continent. Largest of its internationally.

DST, Deepmind

Other workshops

African Institute for Mathematical Sciences

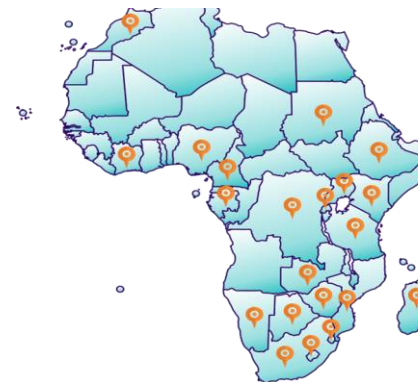
Square Kilometer Array

Women in Machine Learning

Collaborations with international community:

Data Science Africa

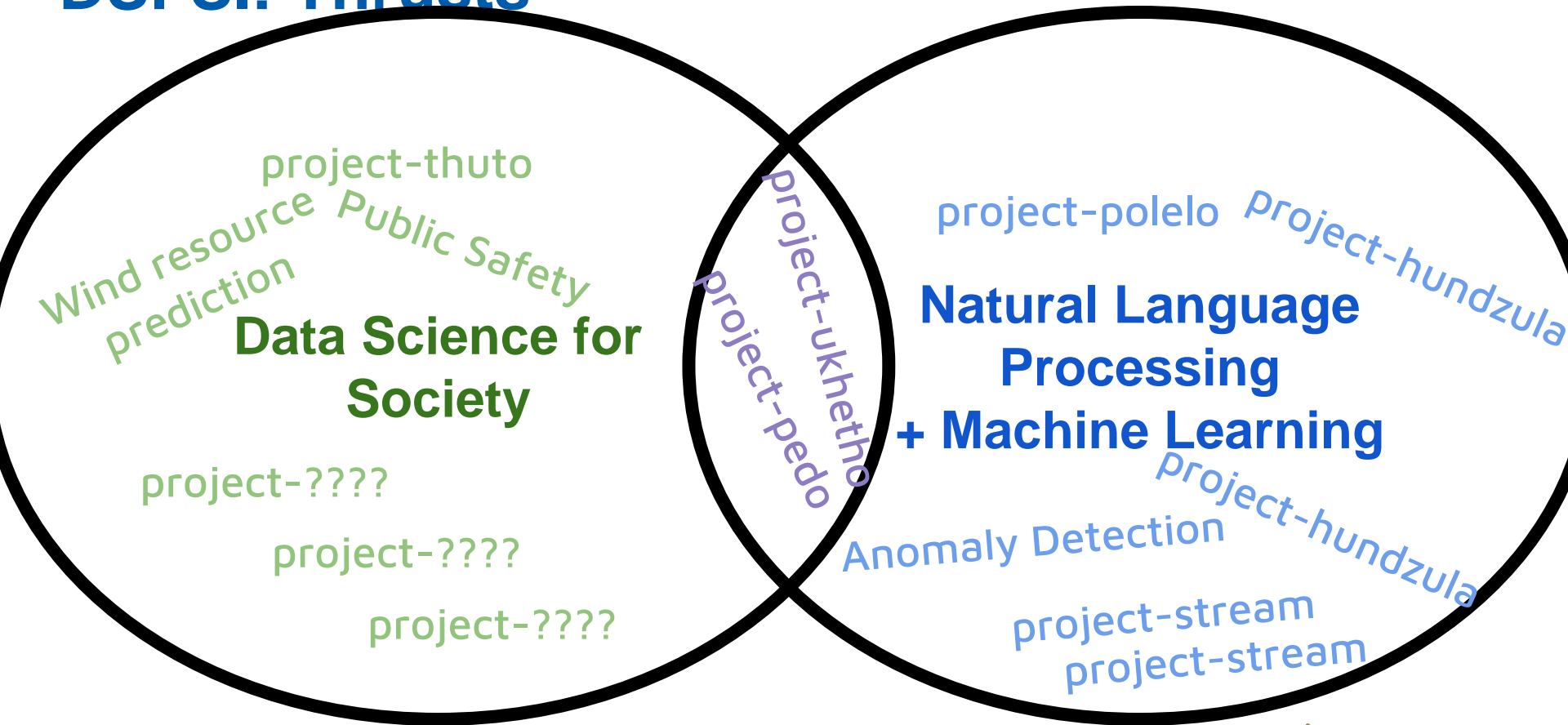
Black in AI



Data Science for Social Impact [DSFSI]



DSFSI: Thrusts



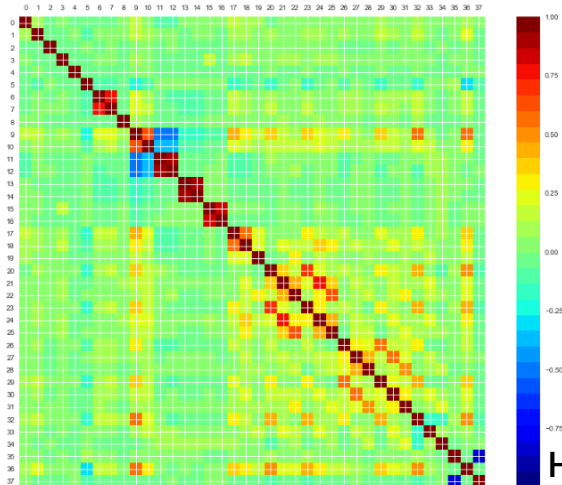
DSFSI: project-thuto - Sierra Leone

Input

```
Index(['UsableWaterSource_Category_EduTrac',  
      'TeachersRegistered_Value_EduTrac', 'TeacherTraining_Category_EduTrac',  
      'TeachersGovPayroll_Value_EduTrac', 'UsableLatrine_Category_EduTrac',  
      'BoysEnrolled_Value_EduTrac', 'BoysToday_Value_EduTrac',  
      'GirlsEnrolled_Value_EduTrac', 'GirlsToday_Value_EduTrac', 'sch_type',  
      'feeder_school', 'remoteness', 'sch_mobile', 'sch_email', 'sch_owner',  
      'approval_status', 'fin_support', 'shift_status', 'mixed_school',  
      'non_formal_sch', 'other_sch_shifts', 'sch_fenced', 'boarding',  
      'sch_garden', 'sch_feeding', 'feeding_wktimes', 'library', 'sci_lab',  
      'canteen', 'rec_facilities', 'elec_grid', 'generator',  
      'oth_power_source', 'func_staff_room', 'computers', 'basic_comp_skills',  
      'drink_water', 'avail_hand_wash', 'avail_latrine_fac',  
      'shared_latrine_fac', 'private_cubicle', 'solid_class',  
      'chair_good_cond', 'benches_good_cond', 'good_pup_desk',  
      'teach_good_desk', 'teach_good_chair', 'chalk_board_good',  
      'sch_dev_plan', 'sch_bank_account', 'Pass', 'Sat', 'learning_rate'],  
      dtype='object')
```



EDA



Logistic
Regression

Feature Importance

Forests of
trees

XGBoost

Work with

Henry Wandera [UP], David Sengeh [Sierra Leone DSTI, SL]

2953 schools

93 variables

Accurac
y83.96
%

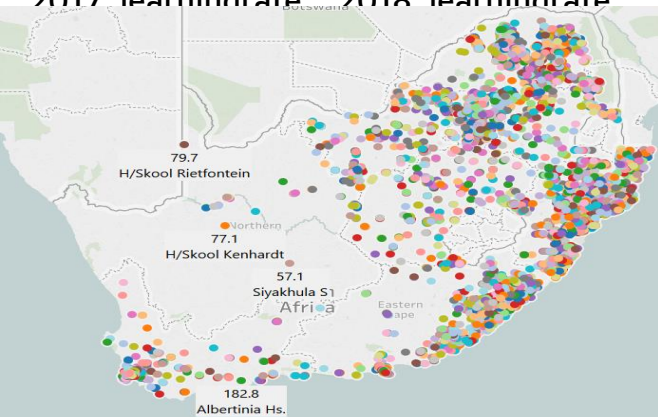


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DSFSI: project-thuto - South Africa

Input

'MunicDiff', 'RateWater',
'RateElectricity', 'RateToilet',
'RateHospital', 'RateClinic', 'RatePolice',
'RateSchool', 'WaterSource',
'DistanceWater',
... 'Ownership', 'E_Mail',
'Registration', 'NoFeeSchool',
'Urban_Rural', 'Open_Boarding_school',
'quintile', '2016_learningrate',
'2017_learningrate', '2018_learningrate'



Work with
Henry Wandera [UP], David Sengeh [Sierra Leone DSTI, SL]

DSFSI: project-pedo

Digital forensics to identify behavioural factors for sexual predators - a Machine Learning approach [Cyber Safety]

Important for finding and understanding

- Cyberbullying
- Sexual Predation
- Fake news etc.

DSFSI: Others

- **Renewable Energy**
 - Shane Van Graan
 - Nkosinathi Hlophe
- **Public Safety**
 - Mpho Mokoatle
- **Fraud**
 - Tshepiso Mokoena
 - Mario Naidoo
- **Novelty Detection**
 - Tshepiso Mokoena



DSFSI: Opportunities

Business School
Computer Science
Computer Engineering
Economics
Industrial Engineering
Informatics
Information Systems
Geoinformatics

- **Collaboration**
 - Invest in students
 - MSc, PhD, Postdocs in the area
- **Data Science Intensives**
 - Problems (Society, Science, Business)
 - Sprints (3 months)

DSFSI: Community

Independent Tiny Newsletter

<https://tinyletter.com/datascience-up>

Engagements outside UP

- SITA
- SARS
- Yes4Youth
- City of Tshwane
- World Bank
- African Union



Thank You

Dr. Vukosi Marivate

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vima.co.za/research

@vukosi

It takes a village



PostDocs: Loading

PhD Students: Abiodun Modupe

Masters Students: Jessica Nemasisi, Tshepiso Mokoena, Hombakazi Ngejane, Mario Naidoo

MIT Big Data Science Students: Henry Wandera, Avashlin Moodley, Nicolle Garber

Interns: Tshepiso Sefara, Niciah Hlungwane

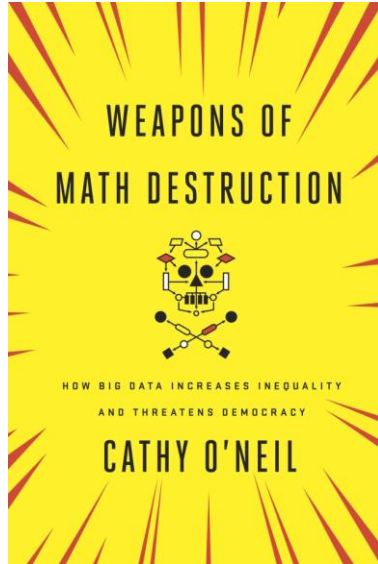
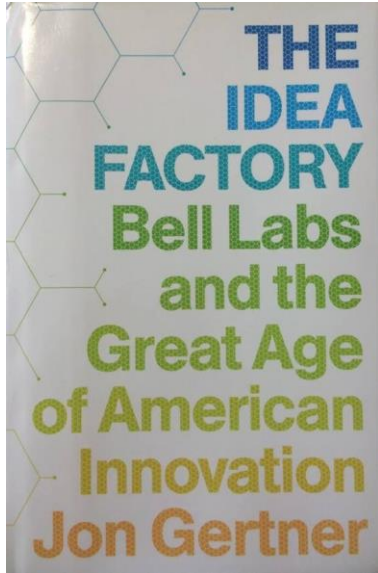
Past Vac or Interns: LeeAnne Masilela (Wits), Thandile Xiphu (UCT), Yanga Sisilana (NMMU), Katlego Mogokonyane (NWU), Nhlamulo Chauke (UL), Pelonomi Moiloa (Wits),

Gary Bezeidenhout (Wits), Nkosinathi Ndlovu (Wits), Abel Letoaba (SMU), Komana Morris (UL), Kaveshan Naidoo (UNISA), Purity Molala (UL), Tlou Boloka (NWU), Theron Khosa (UJ), Nolihle Gulwa (WSU), Wandisa Mfenguza (UFH), Ndamulelo Nemakhavhani (UCT), Nombuso Zondo (UKZN), Thulani Memory Khumalo (UCT), Zimkhitha Sijovu (UFH), Thulani Pride Ngonyama (UP), Olwethu Madikwa (WSU), Louisa Sommerville (UP), Carel Chachi (SMU)



Made with ♥ in Tshwane

Thank You



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