Indaba at a Glance

Tutorials

Sunday 10 September
4:30pm Mathematics for Deep Learning, Marc Deisenroth

Monday 11 September
8:30am Indaba Opening, Adam Habib
9:00am Machine Learning Fundamentals, Willie Brink and Nyalleng Moorosi
2:00pm Deep Learning Fundamentals, Yann Dauphin

Tuesday 12 September
8:30am Convolutional Networks, Nando de Freitas
2:00pm Recurrent Networks, Stephan Gouws and Richard Klein

Wednesday 13 September
8:30am Probabilistic Reasoning, Konstantina Palla
11:00am Unsupervised Learning, Alta De Waal
2:00pm Deep Generative Models, Ulrich Paquet

Thursday 14 September
8:30am Introduction to Reinforcement Learning, Vukosi Marivate and Benjamin Rosman
11:00am Advanced Reinforcement Learning, George Konidaris
4:30pm Machine Learning for Healthcare, Danielle Belgrave

Friday 15 September
8:30am Keynote on Advanced Topics, Anima Anandkumar
11:00am Panel Discussion on African Machine Learning, Bubacarr Bah, Michelle Gervais, Fulufhelo Nelwamondo, Imraan Patel

Practicals

Monday 11 September
11:00am **From Linear to Non-linear Models**
4:30pm **Deep Feedforward Models & Best Practices**
Tuesday 12 September
11:00am **Convolutional Neural Networks**
4:30am **Gated Recurrent Models**
Wednesday 13 September
4:30pm **Variational Autoencoders**
Thursday 14 September
2:00pm **Deep Reinforcement Learning**

Events

Sunday 10 September: 6:45pm-11:30pm
Katy's Palace, Sandton.
Return busses to venue.
Monday 11 September 7:00-10:00pm
Poster and exhibition night,
Science Stadium
Tuesday 12 September 7:00-10:00pm
Poster and exhibition night,
Science Stadium
Thursday 14 September 6:45pm-11:30pm
Braamfontein. Bus/Walk there and back.

General Information

Registration

Collect name tags and welcome packs on:

- *Sunday, 10 September 3:30-4:30pm*
- *Monday, 11 September, 7:30-8:30am.*

Indaba Venues

- Lectures: Science Stadium Auditorium 2.
- Practicals: Science Stadium 1st floor
- Lunches: Tented area.
- Poster sessions: Courtyard

Security and Safety

Like most cities, it is safer to walk in Braamfontein with a group and to keep valuables out of sight.

Access to the University precinct is secured. To gain access, you will need to show your name badge. **Keep your badge on you at all times.**

WiFi Access

Use the Eduroam service if you can access this service. Or Access the guest Wifi:
Network: WITS-WIFI-GUEST
Password: check signs

Sponsor's Area

There is a **sponsor's area** outside the main auditorium from **Monday to Thursday**. Please visit them throughout the day, during the breaks or practicals and ask them about their work, recruitment, etc.

Posters & Prizes

The poster and exhibition sessions will be held on Monday and Tuesday night. This is a relaxed event, and the usual way in which research is communicated at the major machine learning conferences. We encourage everyone to make the best posters they can: **there will be prizes** to give away to posters and presenters that shine. Check your allocation (on the website, or at the end of this programme).

Tutors

Several tutors are around to help with the practicals. seek them out for help; you will see them in blue tshirts. *For questions after the practicals, ask them on Piazza* and someone is sure to respond.

Piazza Q&A

Please ask as many questions as possible! To make this easier, we have an online question and answering tool called Piazza. You can ask questions, associate them with specific tutorials or practicals, answer questions from other attendees and get answers from the speakers. Check the website for login details.

Computing and Setup

You **do not** need a computer of your own, though use your own if you'd like. You only need a browser and an internet connection. Before attending the indaba you will have been asked to set this up (see webpage or your email for details

Evening Events

We have two social activities for everyone at the Indaba to get to know each other better. These are inclusive events for everyone to meet, and to build collaborations and friendships.

Opening Event

- Katy's Palace, Sandton. Sunday, 6:45pm-11:30pm.
- A first opportunity for everyone to get to know each other.
- Our theme for the night is: *Ignite-A rooftop experience*, inspired by the desire and importance to bring things to life (ideas, concepts, images).
- Busses to Sandton and back.
- **Must have badge for access.**

Closing Event

- RetroRabbit, Braamfontein, Thursday, 6:45pm-11:30pm.
- A way to celebrate all we have learnt and achieved over the week. This event is hosted in partnership with RetroRabbit.
- Busses to the venue and back.
- **Must have your badge for access.**

Be The Talking Drums of Africa Renewed: Sharing Knowledge Beyond the Indaba

We designed the Deep Learning Indaba as a gathering of our African community to teach, learn and debate the state-of-the-art in machine learning and artificial intelligence. Our aim during the week will be to build an understanding of the principles and practice of modern machine learning. Of equal importance is the creation of an environment that enables continental collaborations, a raised awareness of the breadth of machine learning career-paths, and that fosters new understandings and friendships.

We leave the legacy of this Indaba to you, its participants. To each of you we ask: take your experiences and the lessons you will have learnt, and replicate it in your own universities, residences, labs, and offices. Spread your understanding of machine learning as far as you can. This is the way that you will take ownership of the field; how you will strengthen African machine learning.

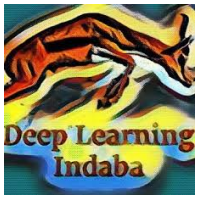
The Indaba will host over 300 people, with representatives from 22 African countries, comprising 33 African research institutions. But we received more than 750 applications. For every person that will attend the Indaba, there is more than one person who we could not accommodate. This makes it critical for us to take our knowledge and experiences and to share it with others.

To make this possible, all the tutorials will be recorded and available online each day to re-watch and share. The practical material will be available for everyone to use, teach from, and modify. We'll be creating new pages on our website with other useful resources (including other learning materials, scholarship and funding opportunities, and infrastructure resources). And a Machine Learning and Data Science in Africa network mailing-list (join now)--a way to connect to the continental community working in machine learning and data science in all its forms--so we can more easily ask each other questions, share research and job opportunities, and build collaborations.

The drum language of the Kele people, sophisticated and proud, once spread knowledge to the far reaches of their communities. These talking drums of Africa are no longer with us. But they can be renewed, in us. As the Indaba closes, this will be our call-to-action: to be the talking drums of Africa renewed. To share what we know. To carry our lessons as far as we can. To use it for the good of our societies. To work towards a shared purpose that secures our continent's place at the rendezvous of victory.

Thanks to our Sponsors

The Indaba is grateful to our sponsors, all committed to strengthening African machine learning. Each of the sponsors will be represented at the Indaba, and attendees can meet with them to get a sense of the ways they use machine learning is used in practice, learn about their work, and to better understand the potential career paths on offer. Read more about the work of our sponsors at the end of this programme.



DeepMind

University of the Witwatersrand, Johannesburg

Retro Rabbit

Google

Standard Bank

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

MaSS
DST-NRF CENTRE OF EXCELLENCE IN MATHEMATICAL & STATISTICAL SCIENCES

Opti-Num Solutions

IBM

ABSA

makro

PROWLER.io
the principled AI company

AIMS
African Institute for Mathematical Sciences
SOUTH AFRICA

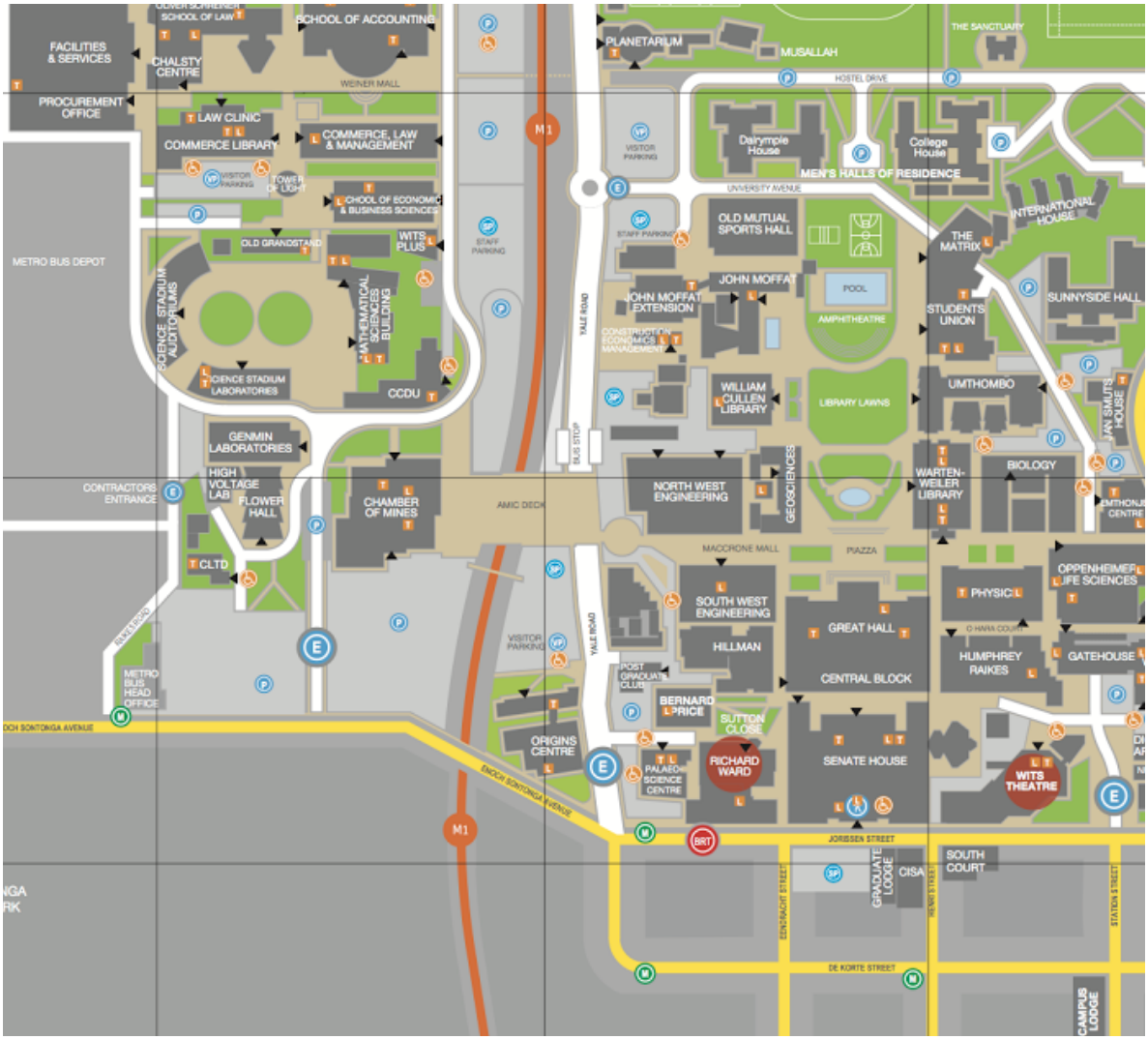
CSIR
our future through science

Indaba Organisers

If you see the organisers around, say hello and give feedback to make the Indaba better.

Maps and Locations

The Indaba will be held in the Science Stadium. This is a map of the campus for reference.



Monday Posters and Exhibitions

Posters

1. **Abbott** Nature inspired swarm robotics algorithms for prioritized foraging
2. **Adebanjo** Feature extraction of hyperspectral images
3. **Ajoodha** Computationally tracking direct influence in observational data
4. **Atemkeng** Radio interferometric point spread function morphological distortion: where and why?
5. **Bessinger** An integrated coastal map of South Africa
6. **Biyela** -
7. **Briers** River flow routing using machine learning
8. **Chiundidza** Big data deep learning as an alternative for measurement of socioeconomic indicators in developing countries
9. **Collins** Active learning and system identification in accelerated destructive degradation
10. **Conway** Augmenting word embeddings using knowledge base data extracted from Wikipedia
11. **Cullinan** Agent oriented deep learning
12. **Currin** Computational neuroscience: the brain on AI
13. **De Carvalho** Sales forecasting with multivariate linear regression
14. **de Lange** Plant disease recognition
15. **du Plooy** Applying named entity recognition on the dictionary of Southern African place names
16. **Düsterwald** A computational model reveals the roles of impermeant anions and transporters in neuronal Cl- homeostasis
17. **Earle** Hierarchy through composition with LMDPs
18. **Faustine** Hybrid HMM-deep learning models for low-sampling energy disaggregation problem
19. **Fick** Global, curve-sensitive features for offline signature verification
20. **Gerrand** Deep learning for paediatric chest X-ray screening
21. **Gilani** Generative adversarial networks for natural dialogue generation
22. **Gilbert** NLG for isiZulu sentences using n-grams
23. **Gobonamang** Intelligent DNA sub sequence repeats identification algorithm
24. **Hamed** -
25. **Henha Eyono** Authentication using keystroke dynamics
26. **Hosenie** Source classification in deep radio surveys using machine learning techniques
27. **James** Learning portable symbols for high-level planning
28. **Jeewa** Cryptographically secure pseudo-random number generators using artificial neural networks
29. **Khan** Neural network training optimization through reinforcement learning
30. **Khumalo** Learning context for a deep recurrent neural network language model
31. **Khumalo** Facial recognition
32. **Lala** Unraveling the contribution of image captioning and neural machine translation for multimodal machine translation
33. **Lebese** Stock market prediction using artificial neural networks and support vector machines
34. **Liu** Increasing the trading prediction by mining aggregated human texting messages
35. **Mabaso** Spot detection in microscopy images using convolutional neural network
36. **Malete** -
37. **Malobola** Intelligent process automation
38. **Marais** CNNs for multi-label classification
39. **Marom** -
40. **Masakuna** Tackling inconsistency In classifier fusion

41. **Maselesele** Having vs clustering algorithms for non stationary data streams
42. **McCoy** Machine learning applications in minerals processing
43. **Meyer** Applying word embedding techniques to medical data
44. **Mmopelwa** Big data application on investment portfolio management and returns prediction
45. **Mpondo** Comparison of trend for segments of time series data
46. **Msomi** Data driven approach to business
47. **Mthwecu** Stochastic games
48. **Müller** Compound landmarks for stereo-vision SLAM
49. **Mvelase** Security surveillance deep learning solutions
50. **Nekhumbe** Breast cancer lesion detection and segmentation using machine learning techniques
51. **Nekoto** An African digital colonial museum: using deep learning, evolutionary psychology and big data tools towards a social transformation/cultural appreciation
52. **Nemasisi** Event detection on social media streams
53. **Newman** Video classification using memory augmented networks
54. **Ngejane** Mitigating cyber-crime and child grooming on social media using deep learning
55. **Nimo** Analysis of galaxy kinematics, dynamics and evolution
56. **Nogwanya** Feasibility of nuclear plasma interaction studies with the activation techniques
57. **Oluyide** Unusual event detection in surveillance videos using deep learning
58. **Perlow** Towards a recycling agent using novel material recognition
59. **Peters** Optimal image facetting for direction dependent effects
60. **Pise** Facial image analysis for e-learning
61. **Rajohnson** The role of dust in star formation
62. **Raseonyana** Producing an optimal examination timetable for the University of Botswana
63. **Rens** Incorporating learning into an agent's stochastic knowledge management framework
64. **Roy** Speech emotion recognition
65. **Rozanova** Deep learning in NLP
66. **Seedat** Quadcopter control
67. **Sejeso** -
68. **Setlhake** Deep learning in multi-spectral image classification
69. **Shabalala** Violence detection and characterization in surveillance videos
70. **Sooknunan** Optical/radio transient classification with machine learning
71. **Thompson** The use of contour integrals for error estimation in Gauss quadrature
72. **Torpey** Human action recognition using recurrent neural networks
73. **Toussaint** A knowledge-centric approach to modelling dynamic customer segmentation in domestic load research
74. **van der Walt** Are the mysterious dryland "Fairy Circles" the result of microbial phytopathogenesis?
75. **Vos** Machine learning in astronomy
76. **Woodford** The concurrent development of neural network based simulators and controllers in the evolutionary robotics process
77. **Zangwa** Development of an algorithm for automatic segmentation of foliage images from uncontrolled environment

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Industry Exhibitions

1. ABSA
2. Deep Data
3. IBM
4. Isazi Consulting
5. MIIA, Cortex Logic, Bennit.AI
6. NMRQL
7. Spookfish
8. Stone Three Mining Solutions
9. Wolfram Research

Tuesday Posters and Exhibitions

Posters

1. **Alhassan** Radio sources classification with machine learning techniques
2. **Amima** Applications of machine learning to identify differently expressed genes in breast cancer patients
3. **Angulu** Hierarchical age estimation using facial features
4. **Aniyan** Deep learning for radio astronomy
5. **Arthur** Thermal hydraulics and transient analysis of a nuclear research reactor using CFD code
6. **Ayami** Improving facial recognition algorithms with an application to DUT security
7. **Bayana** Gender classification based on feature fusion
8. **Bester** Model-based reinforcement learning with parameterised action spaces
9. **Booyse** Recurrent neural networks for asset failure prediction
10. **Breytenbach** On the use of neural networks for classifying time series
11. **Chibuye** Low-resource language speech recognition using cross-language phoneme mapping
12. **Chingozha** Stabilisability preserving abstractions of control systems
13. **Chougrad** A deep learning framework for breast cancer screening
14. **Daud** Disability, brain control and ML
15. **de Wet** Automatic recognition of code-switched South African speech
16. **du Toit** A comparative evaluation and analysis of open-source part-of-speech taggers for under resourced official South African languages
17. **Dufourq** Deep neural network architecture optimisation
18. **Egbelowo** -
19. **El Bouchefry** Astrophysical machine learning software: an overview
20. **Gouaya** Face recognition using HOSVD
21. **Grunow** Full 3+1 dimensional simulation of the Boltzmann equation in the context of heavy ion collisions
22. **Gueorguiev** ASTCVS: a cognitive vision system for astronomical phenomenon classification
23. **Hasani** Learning and modeling analog behavior
24. **Hooper** Acting under partial information in virtual worlds
25. **Ikram** Using deep learning with community detection to solve the cold start problem in recommender systems
26. **Jain** -
27. **Josias** Identifying vein intersections in Tsetse fly wing images
28. **Keivani** Tracking moving objects in dynamic scenes
29. **Kekere** Incremental learning for big data
30. **Khoza** A spiking neural network approach to natural language processing
31. **Knowles** GMRT diffuse radio emission cluster survey
32. **Kohlakala** Human ear recognition based on global features
33. **Lai Hong** Adaptive knowledge injection for Monte Carlo tree search
34. **Lambo** Deep reinforcement learning for games of perfect information
35. **Makati** Semi-automated detectable life band
36. **Manabe** African Solutions to Meet SDG 7: Affordable and Clean Energy
37. **Marumo** Data analytic framework for radio astronomy: hierarchical artifact detection (HArD)
38. **Maseko** Optimized path planning and path tracking for autonomous vehicles with a constrained turning rate
39. **Mbonda Tiekwe** -
40. **Modupe** -
41. **Moiloa** Segmentation of low contrast time based neural fluorescence images
42. **Mokoena** Anomaly explanations

43. **Moodley** -
44. **Mostert** Calibration of stochastic processes using neural networks
45. **Motsoehli** Use of spark streaming and gradient boosting to identify application fraud in the retail space in realtime
46. **Mpipi** Predicting students performance using machine learning
47. **Mtetwa** Brain MRI structure segmentation
48. **Muleya** Multiscale modeling TB transmission dynamics
49. **Mvubu** Financial market time series prediction with Long Short Term Memory (LSTM's)
50. **Ndlovu** Stereo image and 3D point cloud mapping and localisation for self-driving cars in outdoor unstructured environments
51. **Newman** Classifying sleep stages from wearable data
52. **Nguyen** Learning to rank from clicks: a probabilistic model for separating relevance from positional bias in search logs
53. **Niit** Applications of reinforcement learning to psychiatric disorders
54. **Nyambal** Automatic parking space detection based on convolutional neural networks and support vector machines
55. **Ofosu Mensah** Investigating relationship between expressed cancer related genes and patient survival
56. **Okouma** A new deterministic scheme for characterizing the organization of (large) prime numbers
57. **Oldewage** Particle swarm optimization in high dimensional spaces
58. **Perez** Supporting the fight against human trafficking
59. **Pretorius** Learning dynamics of neural networks in reinforcement learning
60. **Radulescu** Whole body locomotion planning for quadrupedal systems
61. **Rajaram** Generative adversarial networks
62. **Ranchod** Skill discovery in reinforcement learning
63. **Rapheeha** Artificial neural network
64. **Rice** Discrete mathematics intelligent tutoring system using Bayesian networks
65. **Schuld** Machine learning on quantum computers
66. **Sefala** 3D convolutions for action recognition
67. **Sihlangu** Cognitive MeerKat
68. **Sithole** Big data and IoT
69. **Steyn** Short-term stream flow forecasting at Australian river sites using data-driven regression techniques
70. **Takong** Investigating rainfall spatial variability over the Drakensberg Mountain Range using artificial neural networks
71. **Tavakoli** Deep reinforcement learning for robot learning
72. **Umuhire** Development of a post-processing technique for a quantum key distribution system
73. **van Biljon** The creation of intelligent agents with machine learning
74. **van Niekerk** Direct sampling using the discrete pulse transform
75. **van Niekerk** Online constrained model-based reinforcement learning
76. **Zitha** Fine-tuning radio calibration using machine learning methods
77. **Zwane** Robot multi-tasking using deep reinforcement learning from raw RGBDT data (T for tactile sensor data)

Industry Exhibitions

1. Africa's Talking
2. BusinessOptics
3. Empiric Capital
4. Entelect
5. Opti-Num Solutions
6. Praelexis
7. Retro Rabbit
8. Standard Bank
9. Takealot

More About our Sponsors

DeepMind is a neuroscience-inspired AI company which develops general-purpose learning algorithms and uses them to help tackle some of the world's most pressing challenges. Since its founding in London in 2010, DeepMind has published over 100 peer-reviewed papers, three of them in the scientific journal Nature - an unprecedented achievement for a computer science lab. DeepMind's groundbreaking work includes the development of deep reinforcement learning, combining the domains of deep learning and reinforcement learning. This technique underpinned AlphaGo, a computer program that defeated Go world champion Lee Sedol in 2016 - a breakthrough experts proclaimed to have arrived a decade ahead of its time. In 2014, DeepMind was acquired by Google in their largest ever European acquisition, and is now part of the Alphabet group.

University of the Witwatersrand, Johannesburg Wits University is a research-intensive university, one of the leading institutions on the African continent that produces world-class research that transforms lives and society in multiple ways. Wits offers a free space for the exchange of ideas, a platform for opposing voices to find common ground, and a vibrant intellectual community that fosters debate and knowledge transfer both in and beyond our lecture halls. More than 85% of its research is published in international journals, with Wits publishing more papers in leading journals, such as Science and Nature, than any other African university.

Retro Rabbit is South Africa's leading company for software development, user experience, data science, and design thinking, with over 100 highly-qualified software engineers, data scientists and creatives that build ingenious bleeding-edge, powerful solutions.

Research at Google tackles the most challenging problems in Computer Science and related fields. Being bold and taking risks is essential to what we do, and research teams are embedded throughout Google allowing our discoveries to affect billions of users each day.

The DST-NRF Centre of Excellence in Mathematical and Statistical Sciences (CoE-MaSS) was established in order bring together areas of research excellence in the Mathematical Sciences and Statistics in South Africa. The CoE aims to: promote knowledge and human capital development in areas of strategic importance to South Africa; promote

collaborative research; promote and develop interdisciplinary research; systematically develop a creative research training environment that is internationally competitive; strive for the highest standards of quality, international competitiveness and esteem of their science, and diffuse knowledge to where it is needed.

science & technology
Department:
Science and Technology
REPUBLIC OF SOUTH AFRICA

The DST is putting science and technology to work to contribute to sustainable growth and development in areas that matter to all the people of South Africa. This includes focused interventions and collaborations, which act as catalysts for change in the economy to increase its global competitiveness, and help to address the huge development backlog existing among the poorest communities in our society. Such work is underpinned by strategies to resource and develop science, engineering, technology and innovation, build human capital, promote an information society, and ensure the environmental sustainability of development programmes.

Vision: Increased well-being and prosperity through science, technology and innovation.
Mission: To provide leadership, an enabling environment, and resources for science, technology and innovation in support of South Africa's development.

ABSA

Absa Bank Limited (Absa) is a wholly-owned subsidiary of the Barclays Africa Group. We offer a range of retail, business, corporate and investment banking, wealth management products and services primarily in South Africa and Africa. We are driven by our purpose to help people achieve their ambitions in the right way, and focused on our Goal to become the financial services provider of choice.

Within Absa's technology division, artificial intelligence (AI) is seen as a strategic driver and we have established a core AI team to start introducing these capabilities into the bank. This team specialises in developing machine learning capabilities on the bank's cognitive datasets, ie, voice, image, video and text. Use cases currently in development include conversational chat bots; text analytics on emails and chats; social media analytics, sentiment analysis and automated email classification. The team has also successfully developed a facial recognition prototype that can play a role in helping identify fraud and preventing financial crime.

Opti-Num Solutions

Opti-Num Solutions provide data analytics and simulation based design solutions to a broad range of industries. We use MATLAB and Simulink to deliver these solutions to our customers. Our solutions encompass a range of deliverables, including software tools for your use, upskilling your staff through training and coaching, or using our specialist resources to deliver insights to your organisation or building bespoke applications. We partner with southern African engineering, science and mathematics focussed companies and academia to support, enhance and grow southern Africa's technical community.

makro

Makro has evolved in the retail space from a stalwart warehouse chain to now being able to offer customers a convenient online shopping hub. Makro offers food, the latest electronics, houseware, camping and outdoor equipment and even liquor. A total of 20 Makro stores

trade in South Africa, bringing convenience and affordability to local households and businesses. With the ecommerce addition to our offering, customers can now enjoy Makro's deals and value-added services across a broader reach of locations.

IBM Research – Africa is IBM's 12th global research lab and the first industrial research facility on the continent of Africa. With facilities in Kenya and South Africa, IBM Research – Africa is driving innovation by developing commercially-viable solutions to transform lives and spark new business opportunities in key areas such as water, agriculture, transportation, healthcare, financial inclusion, education, energy, security and e-government. IBM Research – Africa is actively engaging with Africa's innovation ecosystem to kick start new business opportunities and ensure the full commercial viability of its solutions and services. Entrepreneurs, developers and business partners are a key part of IBM's research programs and go-to-market strategy in Africa.

PROWLER.io is a Cambridge, U.K. based start-up with a world-class team of experts in probabilistic modelling, machine learning and game theory. The company is building an AI decision making platform on a foundation of interpretable principles of mathematics and learning. It will enable customers to optimise the millions of micro-decisions that can occur in their complex, dynamic systems, such as online games, autonomous vehicles and smart cities.

The African Institute for Mathematical Sciences (AIMS) is a pan-African network of centres of excellence for postgraduate education, research and outreach in mathematical sciences; with a goal to enable Africa's brightest students to become innovators that propel scientific, educational and economic self-sufficiency. AIMS centres operate in South Africa, Senegal, Ghana, Cameroon, Tanzania. and Rwanda. AIMS South Africa was established in 2003 as a partnership project of 6 universities: Cambridge, Cape Town, Oxford, Paris Sud XI, Stellenbosch, and Western Cape. AIMS South Africa has a well-established Research Centre with various research chairs. One of these, the German Research Chair of Mathematics with specialization in Data Science is funded by the German Federal Ministry of Education and Research (BMBF) through the Alexander von Humboldt Foundation (AvF).

The Council for Scientific and Industrial Research, commonly known as the CSIR, is a world-class African research and development organisation established through an Act of Parliament in 1945. The CSIR undertakes directed, multidisciplinary research and technological innovation that contributes to the improved quality of life of South Africans. The organisation plays a key role in supporting government's programmes through directed research that is aligned with the country's priorities, the organisation's mandate and its

science, engineering and technology competences.

Modelling and Digital Science (MDS) is one of the business units at the CSIR. It conducts RD&I in the fields of information security, advanced mathematical modelling, mobile intelligent autonomous systems (MIAS) and data science. MIAS is a robotics emerging research area focusing on perception, planning, navigation and control using machine learning. The data science group focuses on data science for social impact, using machine learning for predictive policing, data analysis, text analytics and behavioural modelling