

# Exploring AI-developed algorithms to predict elephant movement in a changing climate

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Götz T, Bondarenko A, Jander N, Ernst Y, Huang RM, Bewsher L, Henley MD, Kirkman S, Bunney K, Mandinyenya B, Ntumi C, Coetzee BWT & Guldemond RAR

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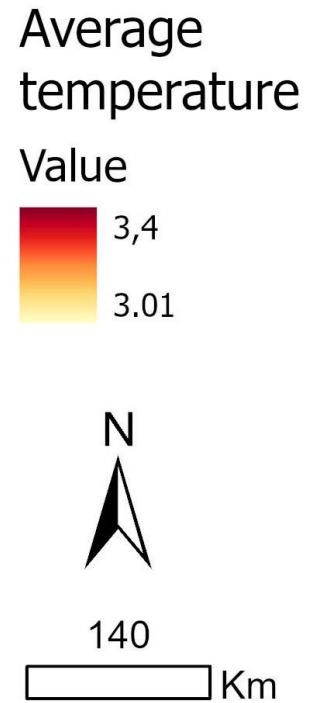
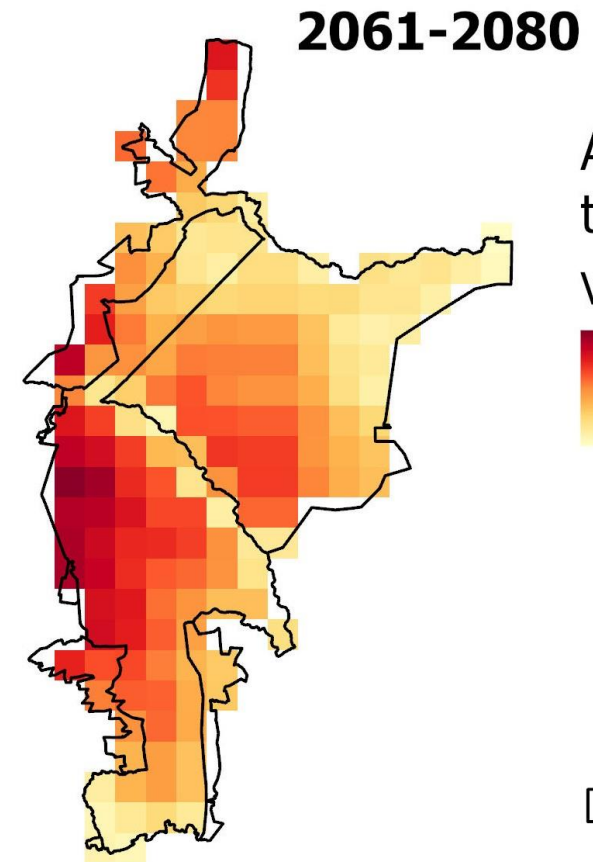
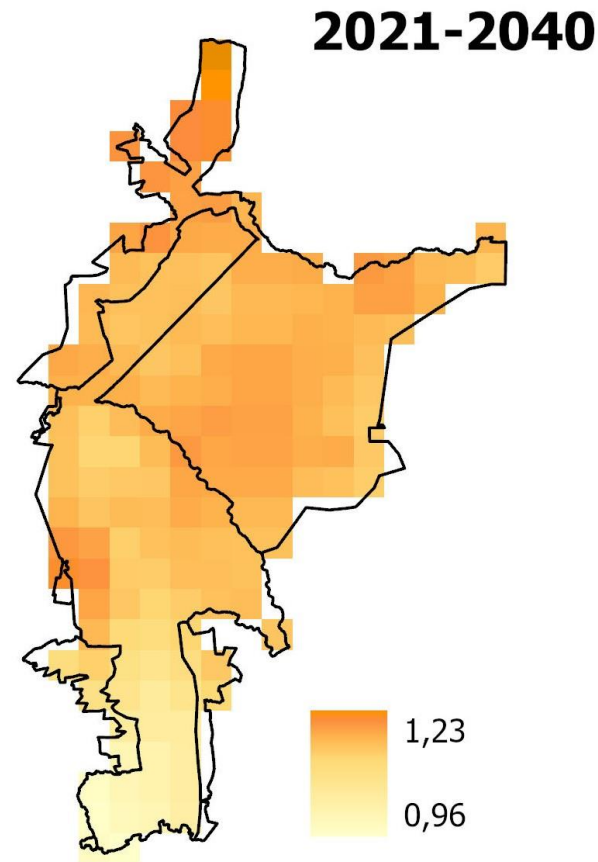
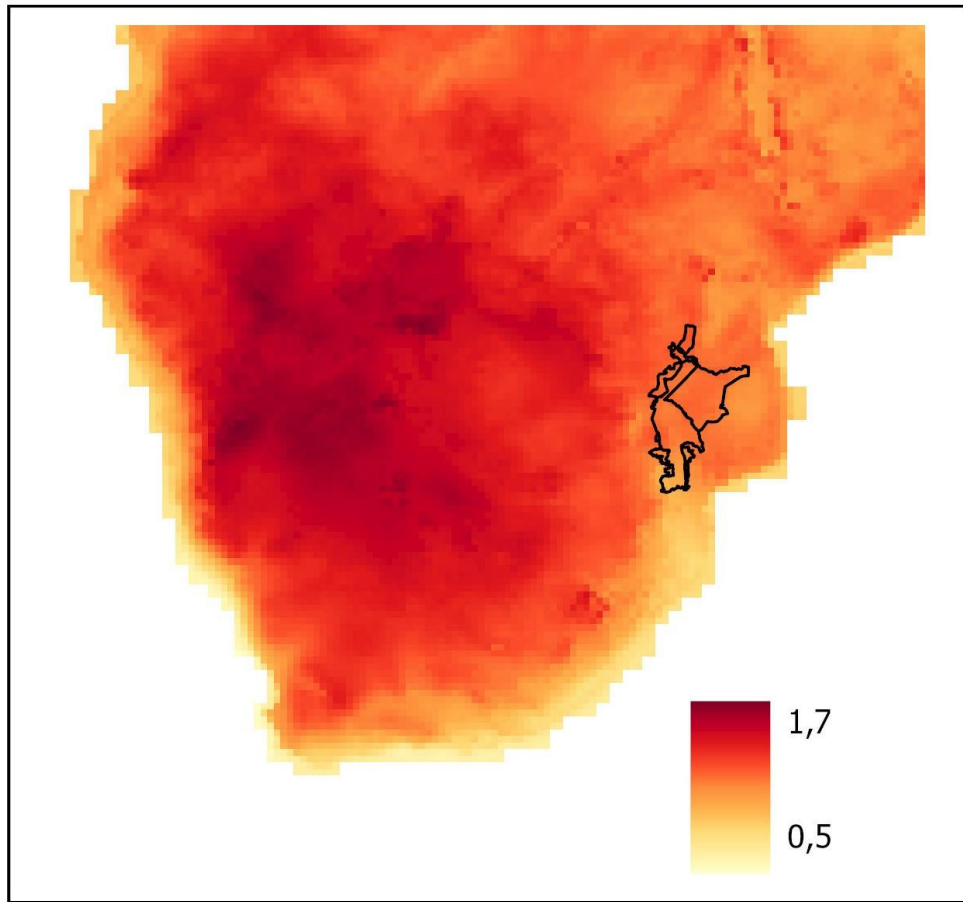
Conflict





Coexistence

# Predicted change in average temperature relative to 1981-2000



# Guided by conventional models

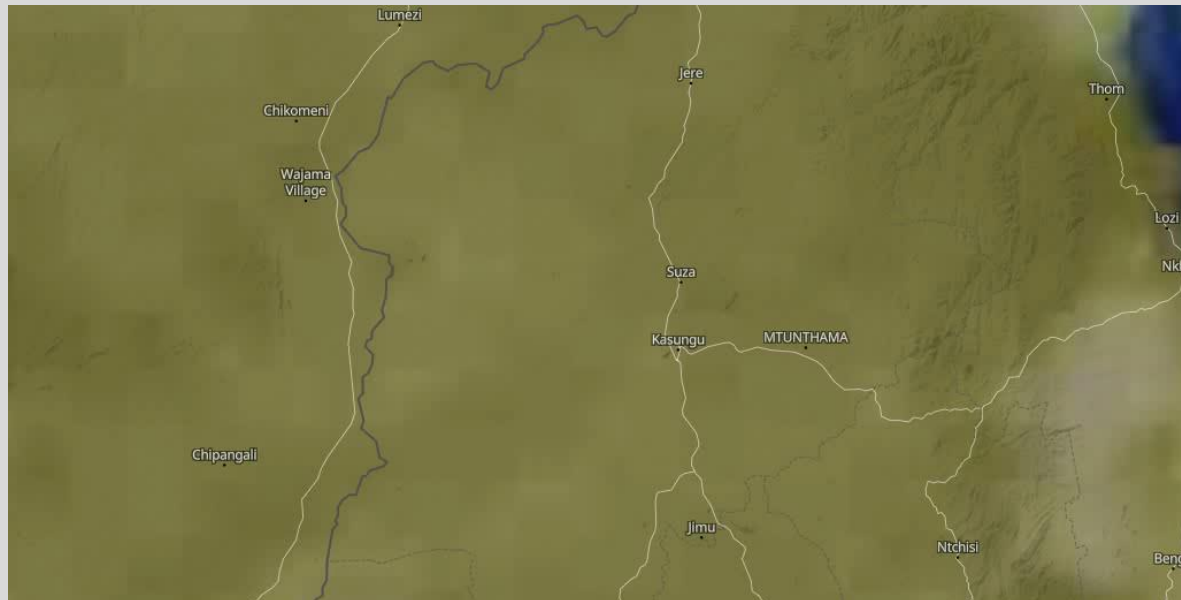
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- pattern recognition in elephant movement
- elephants lack sweat glands, obligate evaporative coolers
- we know:
  - plasticity in behavioural, physiological, and ecological responses
  - at ~30 °C increased shade seeking, wetting, resting
- average increase vs extreme weather conditions
  - direct and indirect effects
  - minimum and maximum temperatures, relative humidity, rainfall

# Data collection and structure



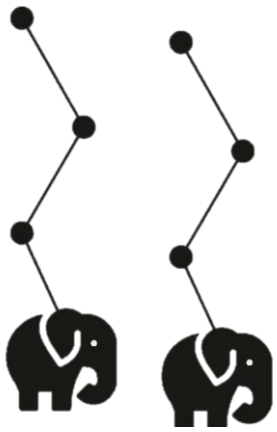
- number of elephants ( $n = 12$ )
- number of GPS locations ( $\sim 200,000$ )



# Our approach

Test neural network predictions with input for feature importance

INPUT



Past movement trajectory

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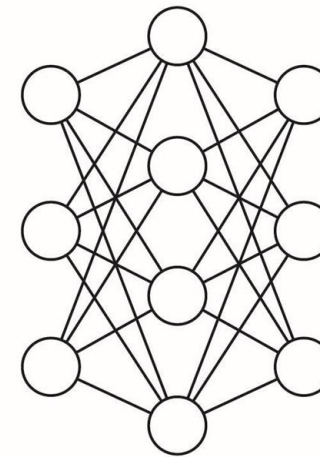
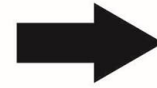


River images

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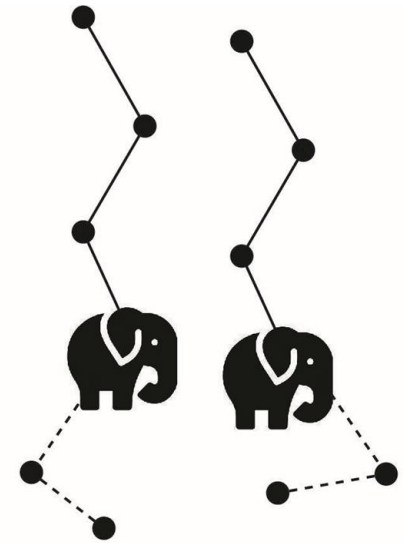
Weather data



Deep Learning Model



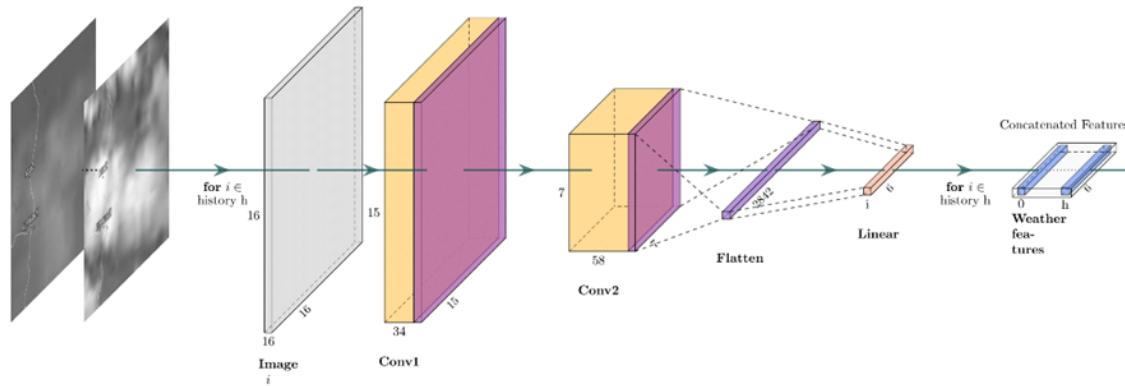
OUTPUT



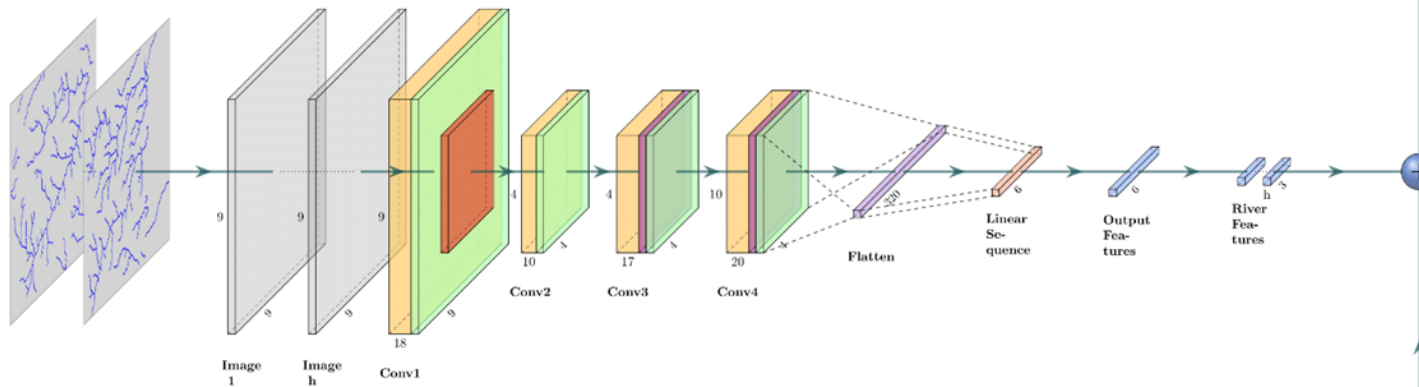
Future elephant positions

# Deep learning model: Transformer Neural Network

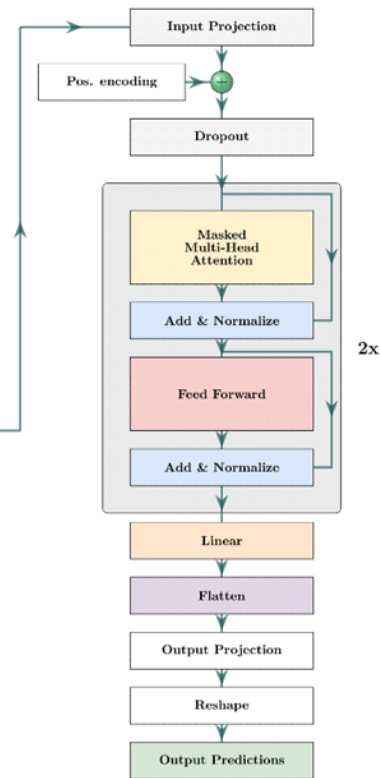
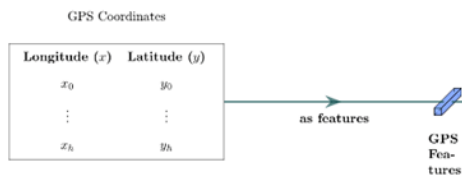
Weather data



River images



Elephant tracking



Prediction of future elephant positions

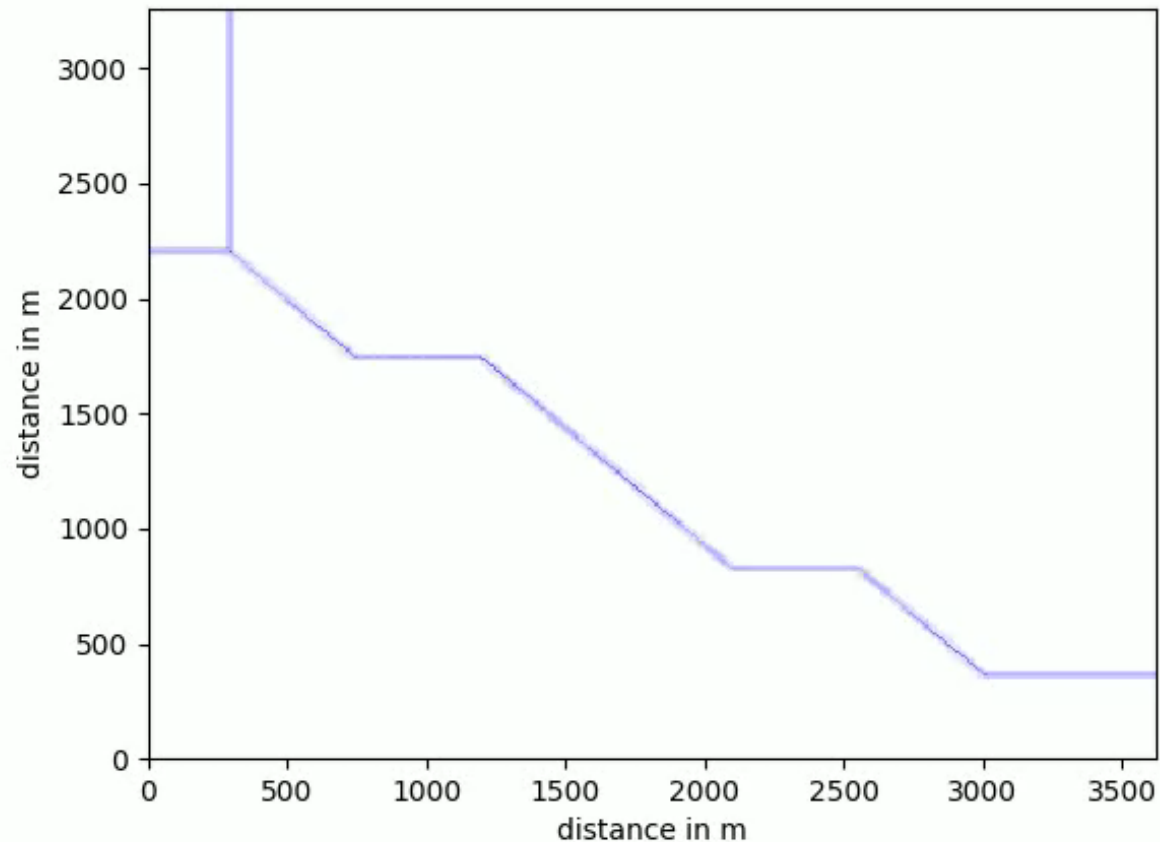
# Preliminary results

- the distance between predicted and true elephant positions -

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Input data	Mean $\pm$ SE (m)
Tracking data	252 $\pm$ 195
Tracking + Weather data	425 $\pm$ 236
Tracking + River images	215 $\pm$ 147
<b>Tracking + Weather data + River images</b>	<b>207 <math>\pm</math> 135</b>

# Preliminary results for the best model



- two hours between locations
- predict 8 hours to the future
- accuracy of ~200m

past trajectory

predicted trajectory

true trajectory

# Next steps

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- with the inclusion of:
  - additional high-resolution tracking data;
  - temperature (daily minimum, maximum);
  - relative humidity;
  - seasonality (hot wet, cold dry, hot dry);
  - land use & change;
  - elephant social dynamics
- to improve the current model
- early warning and detection system for HEC mitigation.

## Great Limpopo Transfrontier Conservation Area Elephant Management Framework

Stakeholder Engagement Report

December 2021





UNIVERSITEIT VAN PRETORIA  
UNIVERSITY OF PRETORIA  
YUNIBESITHI YA PRETORIA



**Prof. Dr. Dr. Theresa Götz**  
Technical University of Applied  
Sciences Amberg-Weiden,  
Germany  
[t.goetz@oth-aw.de](mailto:t.goetz@oth-aw.de)

