MERCY CORPS AGRIFIN

8th ale AGRIFIN LEARNING EVENT

15th- 16th October 2024
Nairobi, Kenya

Enabling rural economies:

Creating lasting impact for the digital ecosystem in Africa.

#ALE2024
#AgriFinALE2024

Enabling On-farm breeding using AI

Presentation by:

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Enable On-Farm Breeding

Conversational Data

NDIZI

Automatic Speech Recognition (ASR)

Speaker

Farmers' Insights and Preferences

Natural Language Processing (NLP)

Speech Synthesis (TTS)

Research at Google

Alliance Bioversity & CIAT

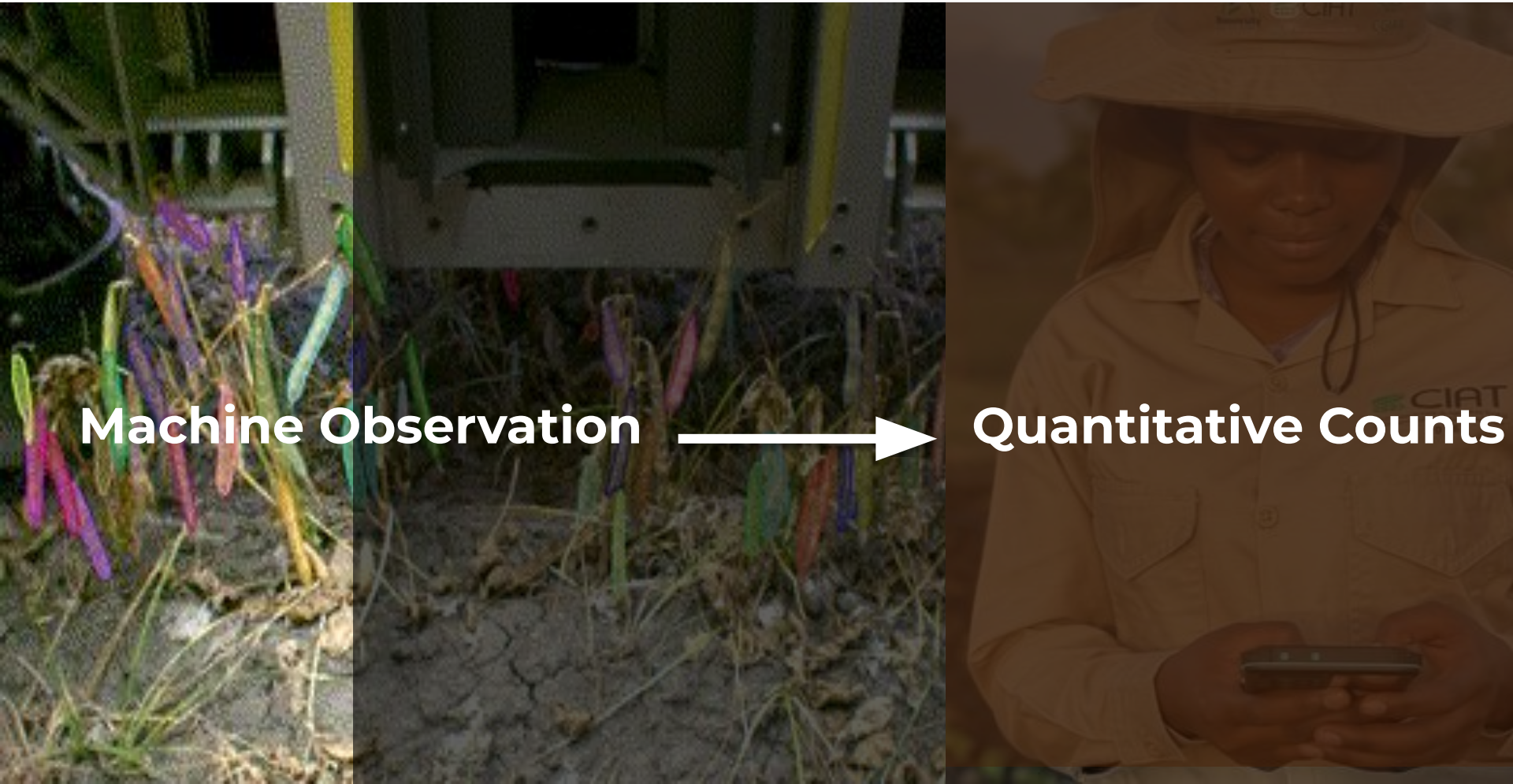
Artemis 2

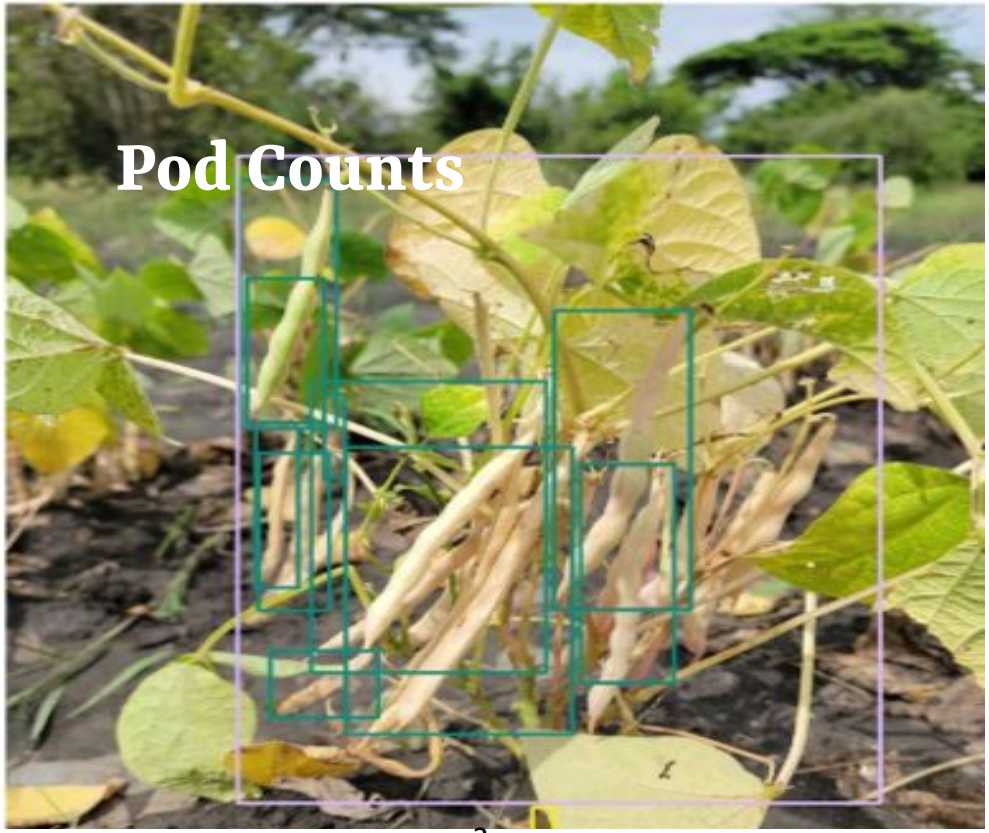
Artemis FM

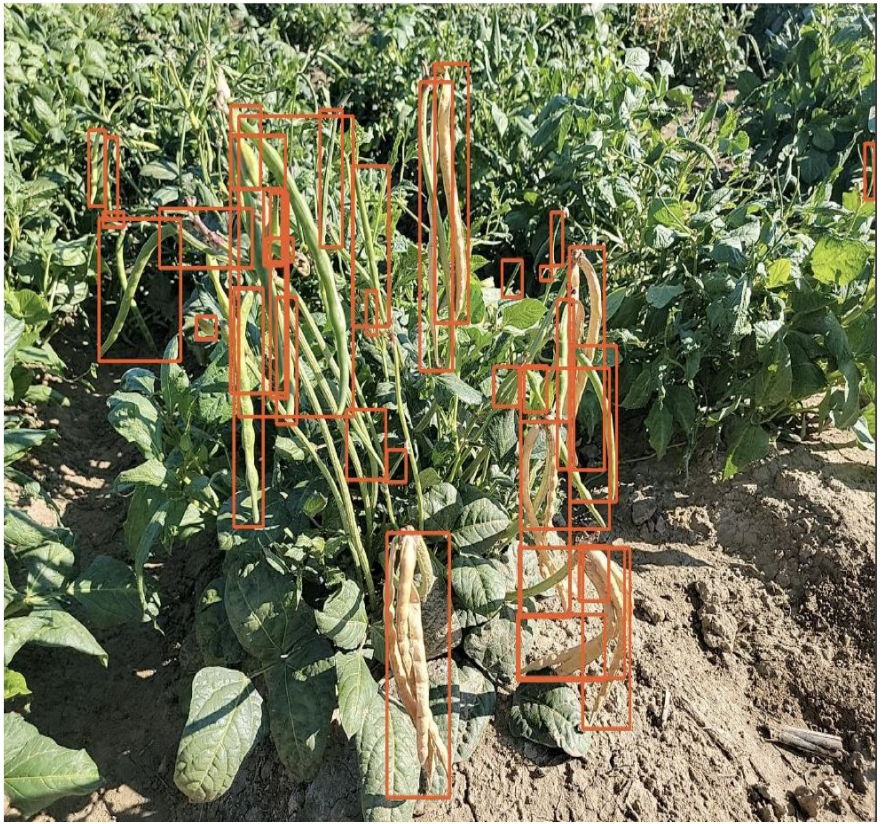
Multi-Modal Analysis

Breeding Decisions

Smart-phone enabled phenotyping


Machine Observation
Quantitative Counts





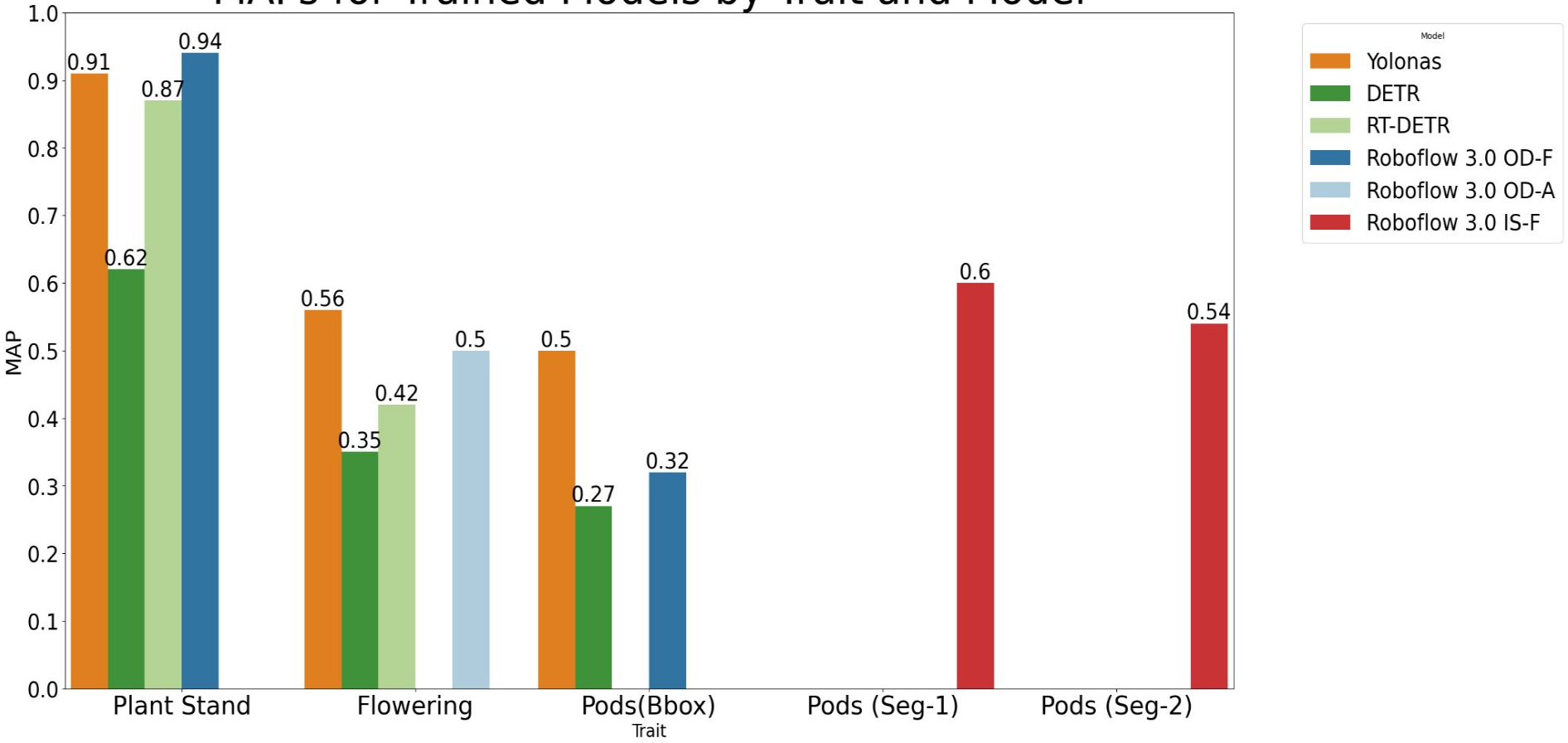
COMMON BEANS r^2 0.84 from ~500 images

COWPEAS r^2 0.83 from ~600 images

COMMON BEANS r^2 0.94 from ~100 images

SORGHUM r^2 0.85 from ~500 images

MAPs for Trained Models by Trait and Model



Eliciting Farmers insights and Preferences

PROBLEM:

When developing new climate adapted crop varieties, improper or incomplete documentation of farmer preferences for new varieties tend to produce varieties that farmers don't want and won't grow.

Farmers growing maladapted varieties are vulnerable to crop loss due to increased climate induced stress, pests and disease for which they were not developed and tested.

HYPOTHESIS:

Use of automatic speech recognition will improve the capture of farmers' feedback for variety trials conducted on their farms including unanticipated traits, diverse terminology, essential variety characteristics, visual indicators of crop performance . This information will generate more accurate farmer typologies and variety target product profiles

Why Highland farmers in Kenya like H 614 D

Traits	H 614 D (released 1986)
Yield	Stable and adaptable in low yielding environment.
Grain	Shiny (appealing when purchasing seed) and round grain appearance. High-density grains that compensate for low physical yield. Grains are hard and resistant to any weevil attack.
Cobs	Very tight cobs that resist rot due to rain and attack by birds. Weevil resistant- cobs always come from the field weevil free.
Stalk	Strong and remain upright after drying.
Taste	Taste good in ugali and for roasting - **superior taste!**
Market	High demand , consumers go for it.
Experience	Farmers used to it as was widely promoted and the market like it

Conventional Approaches

Surveys

Focus group discussions

Questionnaires

Interviews

Choice experiments

NDIZI (NLP to Develop and Innovate Zero-shot Intelligence)

- Develop a robust and scalable speech-based system to understand farmers' insights and preferences.

collection of audio data from farmers in which they express their preferences for different varieties

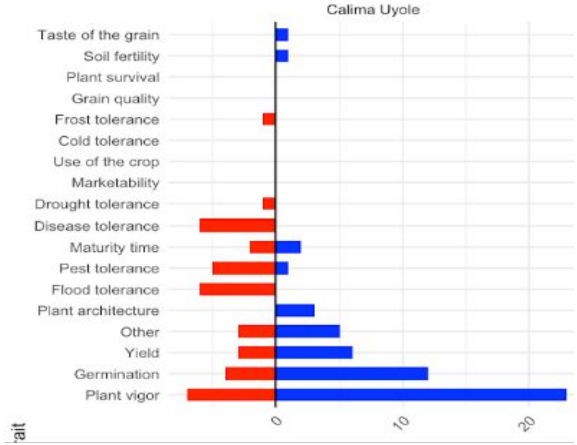
Angalia aina B na elezea chochote unachokiona ambcaho unakipenda kuhusu hiyo? Aina B nimeipenda imetoa vizuri kuliko A na C

Audio transcription

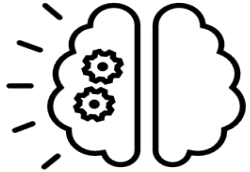
Angalia aina B na elezea chochote unachokiona ambcaho unakipenda kuhusu hiyo? Aina B nimeipenda imetoa vizuri kuliko A na C

Text annotation

ABSA:
Aspect- B
opinion - nimeipenda imeota vizuri
Category - plant vigor
Sentiment - positive
Emotion - Happy



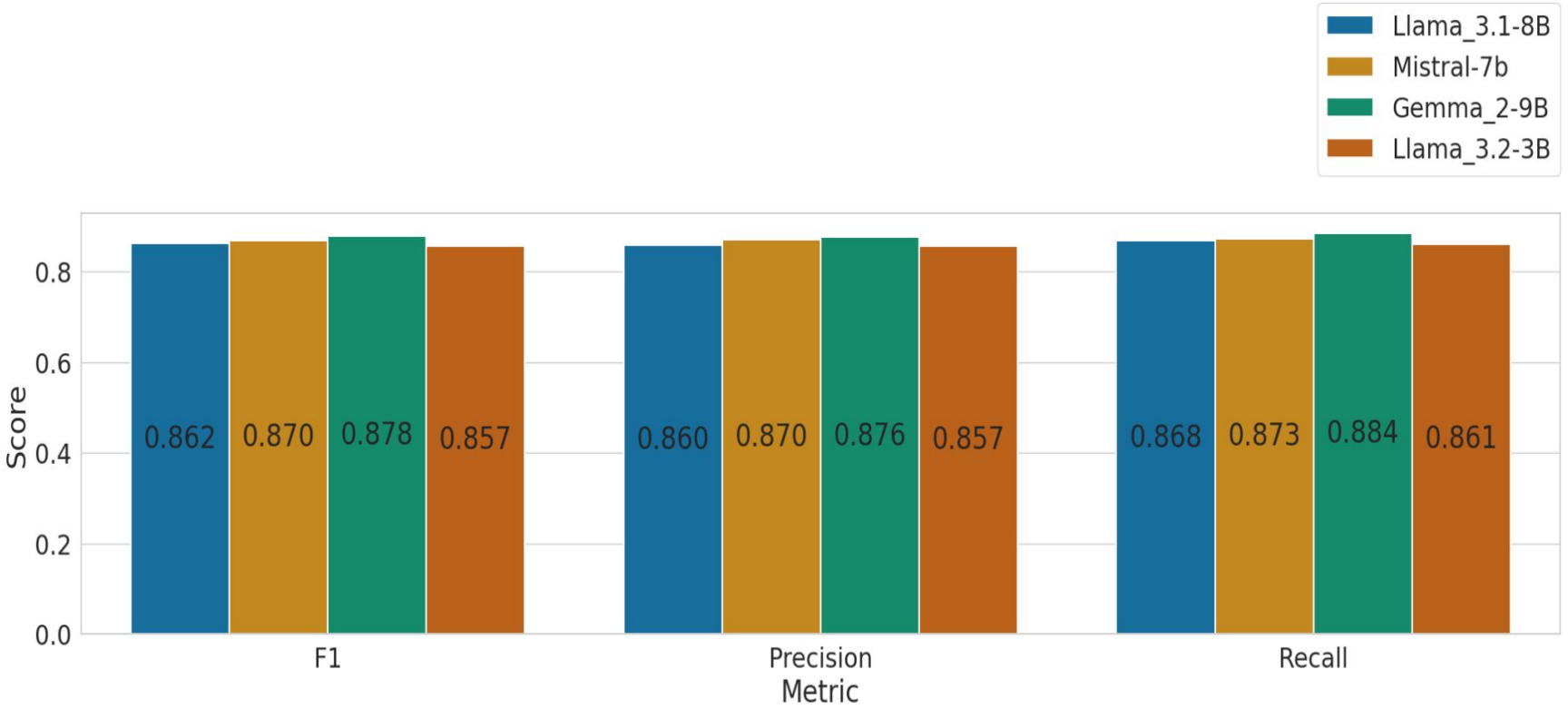
Model evaluation



Model training

Breeders

Model Performance Comparison



Example Output

Sentence

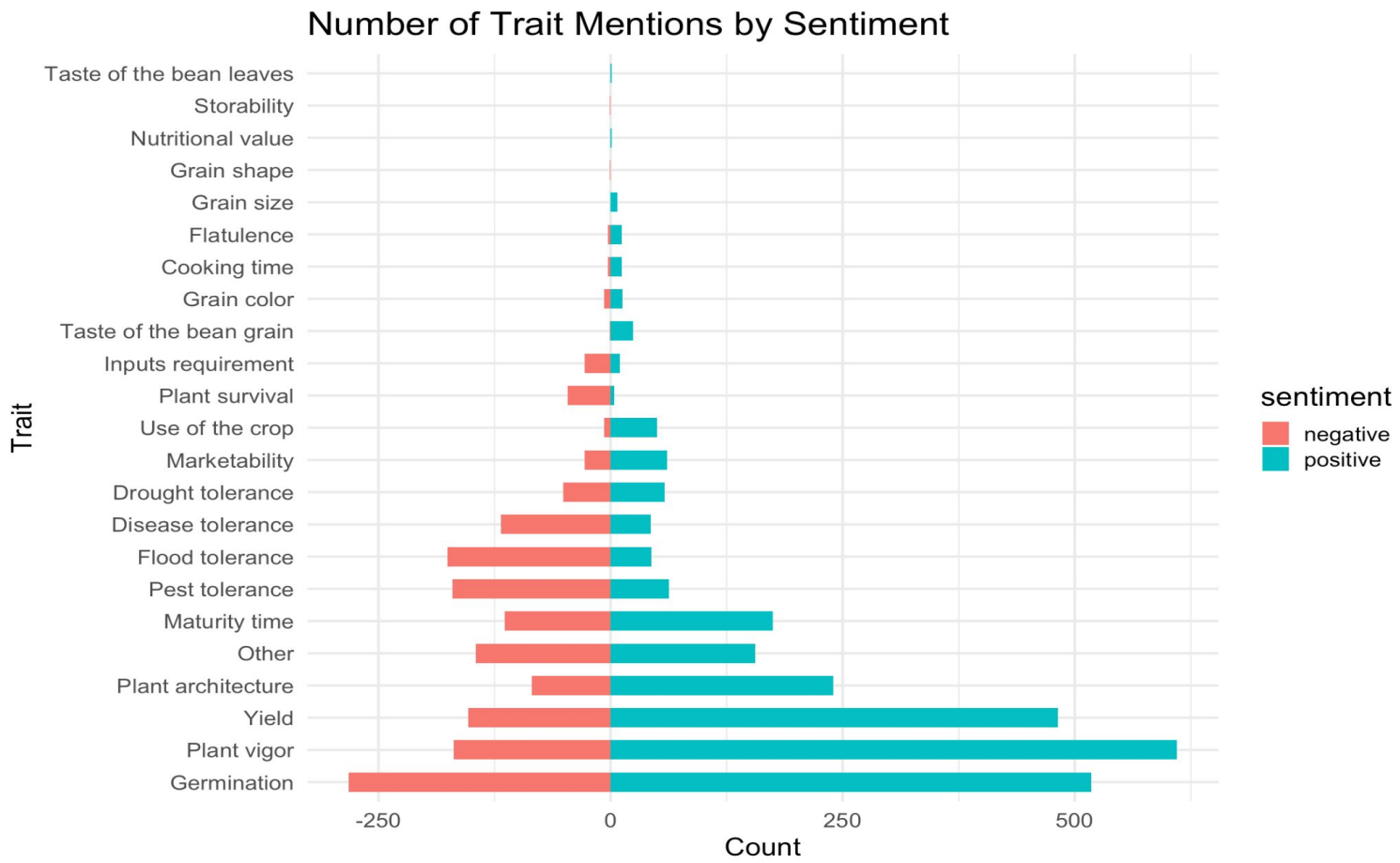
Je kuna kitu chochote hukukipenda kuhusu kukuza aina A? ee ni kuchelewa kuota na kuchelewa kukauka mmm kingine alafu na uzao wake sio mzuri kama C

Model Prediction

A|Germination|negative|kuchelewa kuota|Sadness/disappointment;
A|Maturity time|negative|kuchelewa kukauka|Sadness/disappointment;
A|Yield|negative|uzao wake sio mzuri|Sadness/disappointment

Ground Truth

A|Germination|negative|kuchelewa kuota|Sadness/disappointment;
A|Maturity time|negative|kuchelewa kukauka|Sadness/disappointment;
A|Yield|negative|uzao wake sio mzuri|Sadness/disappointment


Number of Trait Mentions by Sentiment
Taste of the bean leaves
Storability
Nutritional value
Grain shape
Grain size
Flatulence
Cooking time
Grain color
Taste of the bean grain
Inputs requirement
Plant survival
Use of the crop
Marketability
Drought tolerance
Disease tolerance
Flood tolerance
Pest tolerance
Maturity time
Other
Plant architecture
Yield
Plant vigor
Germination
Trait
-250
0
250
500
Count
sentiment
negative
positive

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Thank you for your attention.