Crop classification in agriculture

Nikita Chistyakov, Ranjitha Vadivel, Skander Ben brik

Master's Data Science and Analytics

PROJECT DESCRIPTION

Our company, AgreeCulture, built a client-facing WebApp that allows users to upload a crop image that represents the query as well as a support set containing a list of different crop images. This returns the image from the support set which is the most similar to the query.

We are using few-shot learning trained on the MNIST dataset. Our code learns to recognize the similarities between two images and displays an image from the support set which is the most similar to a query image.
We included an API integrated ChatBot feature allowing users to ask questions about the image they received.

TECH & BUSINESS QUICK FACTS

> Few-Shots Learning model

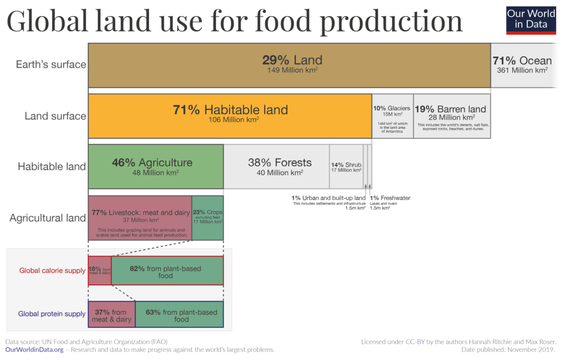
> HuggingFace & ChatGPT chatbot models

> **Web App user interface via online access**

> Approximately 38% of the global land surface is used as agricultural land area

> Massive market opportunity with over a third of the land already used in agriculture and growing demand with population growth

> **Applying the latest technological advances in Deep Learning image classification modeling and LLM-based chatbot for relevant follow-up information requests and convenient one-stop shop**

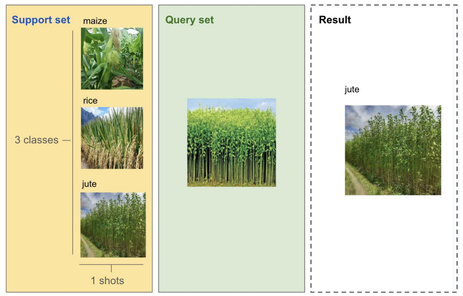


RESEARCH CONCLUSIONS

Developing a deep learning model that can classify images using Few-Shot Learning is a challenging task. But it is an important application of computer vision in the agriculture industry.

> The FSL model allows us to learn from a small number of labeled examples and generalize well about new, unseen images

> Deep learning is a new approach to machine learning, with the ultimate goal of giving machines the capacity for analysis and learning that people possess, enabling them to recognize characters, images, sounds, and other types of data

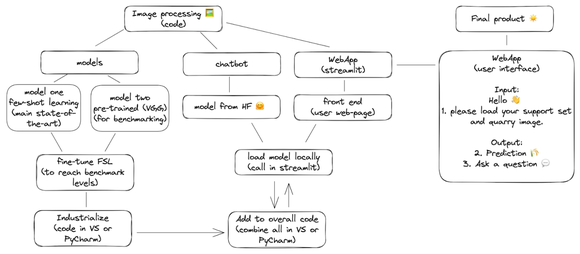


User upload and results example

METHODOLOGY AND TOOLS

- In this project, we have used the Few-Shot Learning technique Siamese model, and a pre-trained benchmark model using VGG16.
- We developed a web application that contains two pages. The first page VGG16 model predicts the crop name, recommended soil, and alternate soil. Whereas the second page contains the Siamese model it predicts the similarity between the query image and support images.
- Also implemented chatbot assistance for our web where user can get all the information related to the crop.

SYSTEM ARCHITECTURE



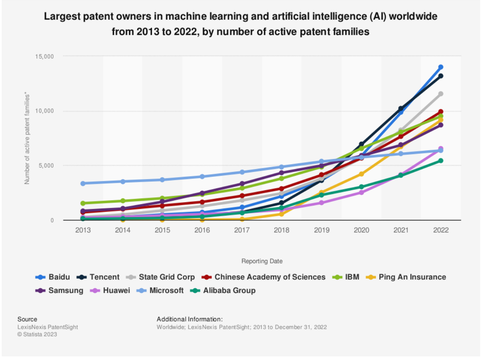
DEVELOPMENT

We used a state-of-the-art model technique called Few-Shot Learning and calibrated its performance against a well-known industry benchmark model called VGG.

> This approach works with as little as 3 images, and our model accurately finds the images most similar to the uploaded support set images

> The results are achieved by benchmarking against the pre-trained model that is trained on a big dataset and learns to look for similarities

> We also introduce an LLM-based chatbot feature into the user interface so that there is a possibility to ask follow-up information regarding the output of the model

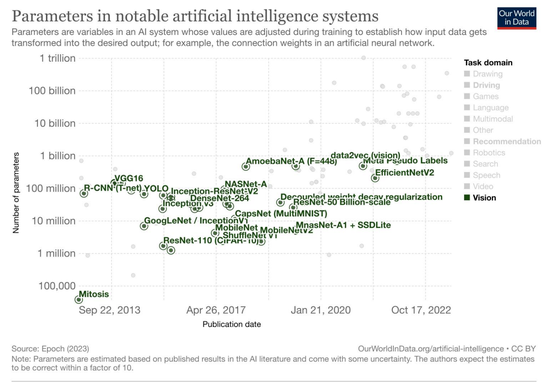


(AI) SUMMARY

AI is one of the fastest-growing fields in the World today. With an abundance of data and computing power, there are limitless opportunities in applying these technologies.

> As of December 2022, Baidu was the largest owner of active machine learning and artificial intelligence (AI) patent families worldwide with 13,993 active patent families owned.

> Artificial intelligence (AI) is heavily used for service operations and strategy and corporate finance, with nearly all industries reporting around 20 percent usage of AI in these functions.



Ten year evolution in Deep Learning and Artificial Intelligence systems by task domain