# Analysis of AI Model Hub

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## Abstract

*Artificial Intelligence (AI) technology has recently grown explosively and is being used in a variety of application fields. Accordingly, the number of AI models is rapidly increasing. AI models are adapted and developed to fit a variety of data types, tasks, and environments, and the variety and volume of models continues to grow. The need to share models and collaborate within the AI community is becoming increasingly important. Collaboration is essential for AI models to be shared and improved publicly and used in a variety of applications. Therefore, with the advancement of AI, the introduction of Model Hub has become more important, improving the sharing, reuse, and collaboration of AI models and increasing the utilization of AI technology. In this paper, we collect data on the model hub and analyze the characteristics of the model hub and the AI models provided. The results of this research can be of great help in developing various multimodal AI models in the future, utilizing AI models in various fields, and building services by fusing various AI models.*

*Keywords: Machine Learning Model, Model Hub, AI Model, HuggingFace, Kaggle, TensorFlow Hub*

## 1. Introduction

Model Hub is a centralized storage and sharing platform for AI models, providing a variety of benefits to AI researchers, developers, and enterprises. This promotes model sharing, reuse, collaboration, and knowledge sharing, advancing AI technology and improving the efficiency of collaborative projects. Model reuse saves development time and costs, and helps improve and optimize model performance. It is also used as an AI education and learning resource and contributes to knowledge sharing and knowledge dissemination in the community. It plays an important role in enhancing security and compliance and safely managing models. Model Hub is a key element that supports progress and innovation in the AI ecosystem [1-3].

In this paper, we collect data on Model Hub and compare and analyze the characteristics of Model Hub.

## 2. AI Model Hub

Model Hub refers to an online platform or service that allows you to search, share, and utilize machine

learning and deep learning models. Model Hub enables data scientists, researchers, engineers, and developers to share and discover models for a variety of machine learning tasks [4]. These platforms are used for the following main purposes:

- Model sharing: Model developers and researchers can share their machine learning models with other users by uploading them to Model Hub. This promotes model reuse and collaboration.

- Model Search: Users can search for desired machine learning models in Model Hub and utilize them for their projects or tasks. This helps reduce model development time and increases efficiency.

- Take advantage of pretrained models: Model Hub provides pretrained models that you can take, finetune, and use in your own tasks. This is a key element of transfer learning.

- Model evaluation and testing: Model Hub is used to evaluate and test various models. Users can compare different models and choose the most suitable one.

- Open source community: Model Hub is part of an open source community, providing a platform to share and collaborate on models and code. This accelerates model development and innovation.

Model hubs with many pre-trained models have become a cornerstone of deep learning [5]. Model Hub provides models of various types and purposes, and this platform helps you utilize and share machine learning and deep learning models more effectively.

## 3. AI Model Hub Sites

### 3.1 HuggingFace

Hugging Face refers to companies and communities active in the fields of Natural Language Processing (NLP) and machine learning. These companies and communities develop and share NLP models and libraries, providing innovative tools and resources for AI research and applications [6].

Hugging Face develops and publicly provides various NLP models and libraries. One of the most popular libraries is "Transformers", which allows you to easily leverage pre-trained NLP models.

Figure 1 shows the Model Page of Hugging Face. The left side of the Model Page shows various model types and sub-models. The right side of the model page displays various cases of the selected sub-model type.
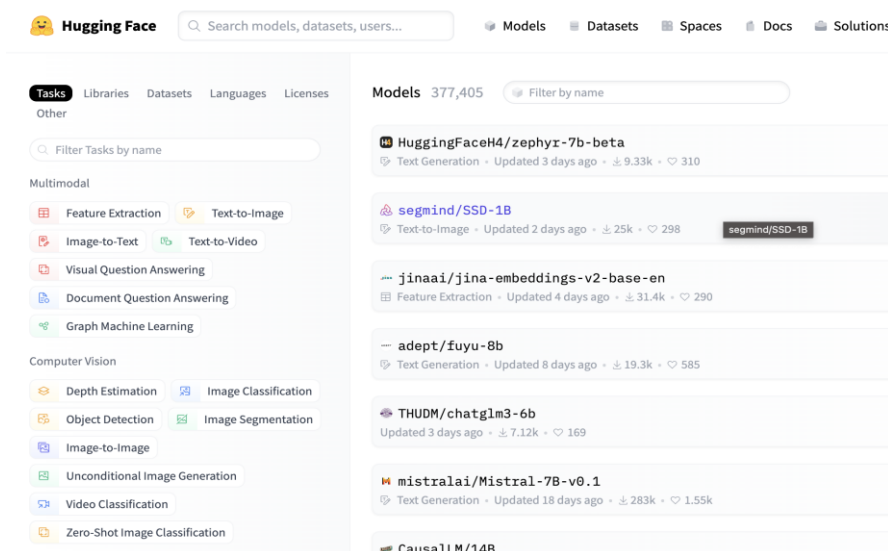


**Figure 1. HuggingFace's model page**

### 3.2 Kaggle

Kaggle is a data science and machine learning community and competition platform, an online platform for data scientists, machine learning engineers, researchers, and other data users [7].

Kaggle Models provides a way to discover, use, and (soon) share public pre-trained models for machine learning. Kaggle Models is a repository of TensorFlow and PyTorch pre-trained models that can be easily used in Kaggle Competition notebooks. Like datasets, Kaggle models also feature community activity that increases the usefulness of the models. Every model page includes usage statistics such as discussions, public notebooks, downloads, and upvotes, which make the model more useful.

Figure 2 shows Kaggle's Model Page. There are various types of models on the model page, and actual models are provided for each model type.
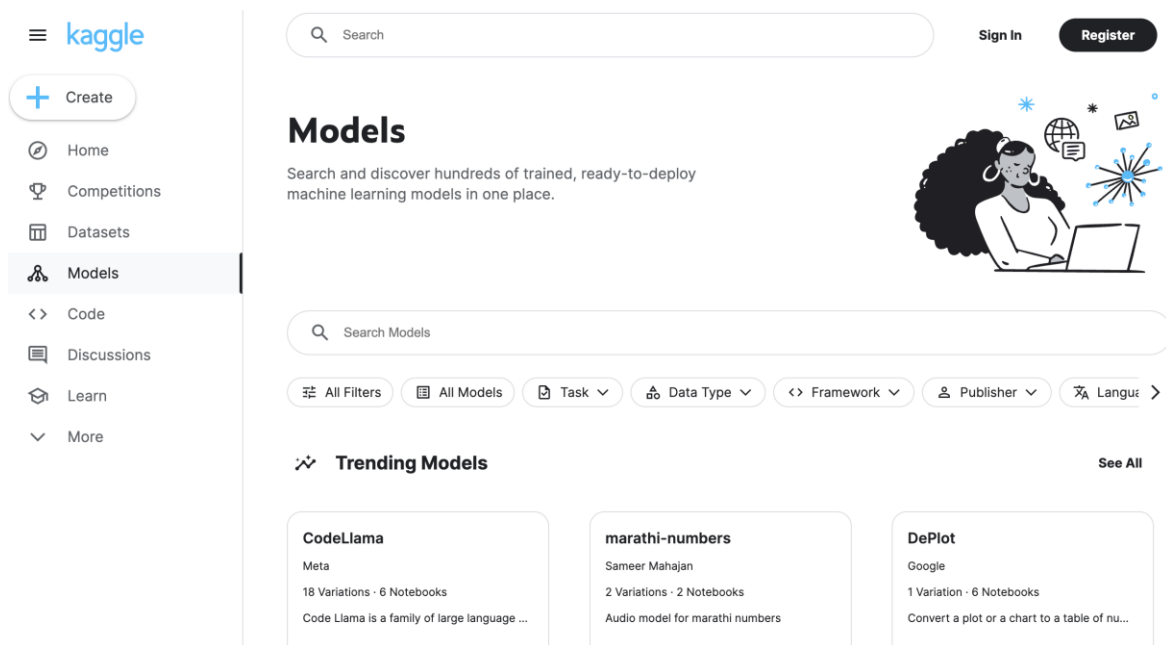


**Figure 2. Kaggle's model page**

### 3.3 Tensorflow Hub

TensorFlow Hub is an open source library based on TensorFlow, and is a platform that allows you to easily share and reuse pre-trained models and model components. Through TensorFlow Hub, you can share and import various deep learning models, model parameters, embeddings, tensors, etc. and use them in your TensorFlow project. You can download the tensorflow_hub library and reuse it in your TensorFlow programs with minimal code [8].

Figure 3 shows the Model Page of TensorFlow Hub. There are various types of models on the Model Page. The left side of the Model Paged shows models in various fields.
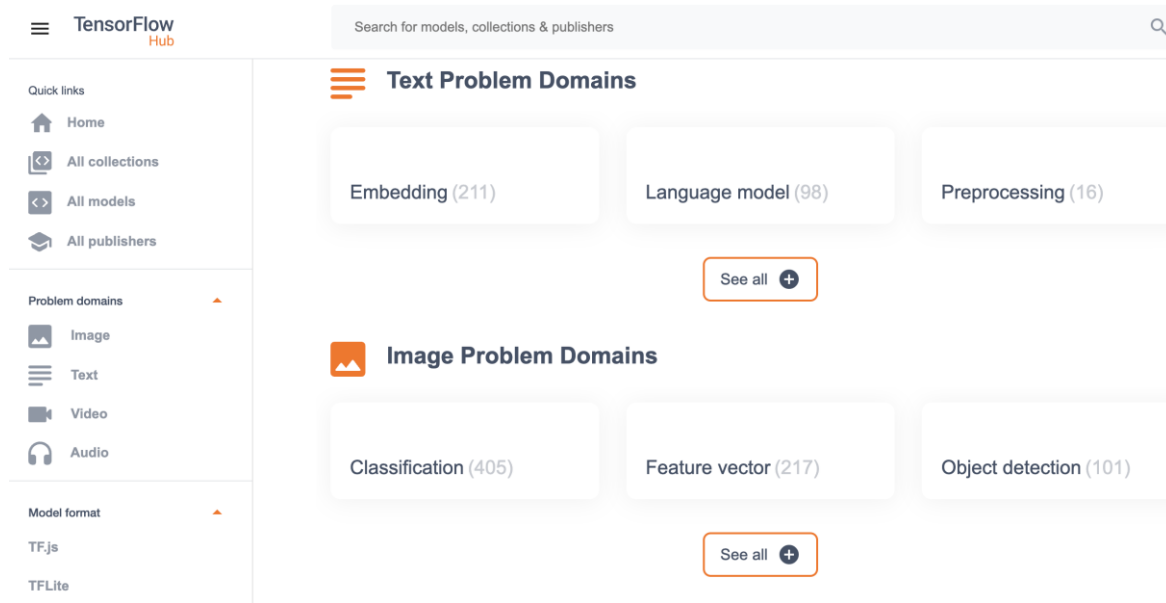
**Figure 3. Tensorflow Hub's model page**

## 4. Comparison of Model Hubs

This section compares different model types and subtypes from Model Hubs such as HuggingFace, Kaggle and TensorFlow Hub. Table 1 shows model types of Model Hubs. Model Hub's AI models support image, text, video, audio, multimodal, and tabular types.

**Table 1. Model types of model hubs**

| Tool | Image | Text | Video | Audio | Multimodal | Tabular |
|---|---|---|---|---|---|---|
| Hugging Face | Yes | Yes | Yes | Yes | Yes | Yes |
| Kaggle | Yes | Yes | Yes | Yes | Yes | No |
| TensorFlow Hub | Yes | Yes | Yes | Yes | No | No |

Most Model Hubs support image, text, video, and audio models, and among them, Hugging Face supports Multimodal and Tabular. Most Model Hubs support image, text, video, and audio models, and among them, Hugging Face supports Multimodal and Tabular.

A multimodal model is an artificial intelligence model that processes and handles several different types of media data, such as images, text, and voice. These models can understand and utilize multiple types of data simultaneously to perform rich and diverse recognition and generation tasks. The Tabular model is one of the models used in the fields of machine learning and deep learning, and is especially useful for dealing with structured data.

Tabular data generally refers to data organized in a table or database format and has a data structure consisting of columns and rows. Tabular models are used to analyze and predict such tabular data.

Table 2 shows model types and subtypes of Model Hubs. Table 2 shows the model types and subtypes in the model hub. Depending on each subtype, it represents detailed models that process specific tasks within

the scope of the type.

**Table 2. Model types and subtypes of model hubs**

| Type | Hugging Face | Kaggle | TensorFlow Hub |
|---|---|---|---|
| Image | Depth Estimation<br>Object detection<br>Image classification<br>Image segmentation<br>Image-to-image<br>Unconditional image generation<br>Zero-shot image classification | Image augmentation<br>Image super resolution<br>Image segmentation<br>Image text recognition<br>Object detection | Classification<br>Feature vector<br>Object detection |
| Text | Text classification<br>Token classification<br>Table question answering<br>Zero-shot classification<br>Translation<br>Summarization<br>Conversational<br>Text generation<br>Text2Text generation<br>Fill-Mask<br>Sentence similarity | Text preprocessing<br>Text classification<br>Question answering<br>Text generation | Embedding<br>Language model<br>Preprocessing |
| Video | Video classification | Video generation<br>Video text<br>Video audio text<br>Pose detection | Classification<br>Feature Extraction<br>Generation |
| Audio | Text-to-speech<br>Text-to-audio<br>Automatic speech recognition<br>Audi-to-Audio<br>Audio classification<br>Voice Activity detection | Audio synthesis | Embedding<br>Event classification<br>Command detection |
| Multimodal | Feature extraction<br>Text-to-Image<br>Image-to-Text<br>Text-to-Video<br>Visual Question Answering<br>Document Question answering<br>Graph machine learning | Speech-to-text<br>Text-to-mel<br>Video Audio Text | |
| Tabular | Tabular classification<br>Tabular regression | | |
| Reinforcement | Reinforcement Learning | | |

| Learning | Robotics | | |
|----------|----------|---|---|

The fact that there are many model subtypes in Hugging Face shows that the community is that active. Hugging Face's text model supports subtypes such as Translation, Summarization, Text generation, Text2Text generation, and Sentence similarity that are not found in other Model Hubs.

Translation is a technology that automatically translates text from one language into another.

Summarization refers to the process of concisely summarizing a long document or text. Summarized content improves reading comprehension by removing unnecessary details while preserving the important content of the original text.

Text Generation is used to automatically write text or create stories based on given hints or context. For example, writing an article, creating a screenplay, or writing a novel.

Text2Text Generation refers to the operation of converting one text into another text. This operation is used for a variety of conversion tasks. For example, converting questions into answers or summaries into original text.

Sentence Similarity is the task of measuring the similarity between two sentences or text fragments. This task is used to determine semantic or structural similarity between two sentences. For example, it can be used to measure similarity between documents or to evaluate the relevance of search results.

Another important result is the emergence of many multimodal models. A multimodal model refers to an artificial intelligence model that processes and integrates multiple types of media (data types). These models can simultaneously understand and process multiple media types, including text, images, audio, and video, and extract or generate useful information from these diverse data sources. Text-to-Image, Image-to-Text, and Text-to-Video models are subfields of multimodal models, which are models that perform conversions between different media types.

The availability of AI model hubs has revolutionized the artificial intelligence development environment. The AI model hub provides a wealth of pre-trained models, code examples, and resources, allowing developers to leverage cutting-edge models and build innovative AI applications more efficiently [9].

## 5. Conclusion

In this paper, we investigated various features of Model Hubs such as HuggingFace, Kaggle and TensorFlow Hub. Advances in AI have made the introduction of Model Hub more important. The explosive growth of AI models has increased the need to share and collaborate on models within the AI community. Reuse and optimization of models are important, and it is more efficient to find and reuse existing models than to recreate them from scratch. Sharing and using AI models maximizes industry and societal impact and provides valuable resources for AI teaching and learning. The security and compliance of your models is also important, and Model Hub helps you securely store and manage your models and ensure security and compliance. For this reason, advances in AI are increasing the need for Model Hub. We collected and analyzed data on the most popular types of model hubs, the various types provided by those model hubs, and the detailed processing areas of those types. The results of this research can be of great help in developing various multi modal AI models in the future, utilizing AI models in various fields, and building services by fusing various AI models.

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