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GRADIO AND HUGGING CAPABILITIES FOR DEVELOPING RESEARCH AI APPLICATIONS

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Recent advancements in neural network training have contributed to significant progress in computer vision, natural language processing, and data analysis. AI modules are used in education, medicine, security, autonomous systems, etc. However, their implementation requires rapid hypothesis testing, optimal solution selection, dataset collection, expert evaluation, etc. For example, in the work [2,6], it was necessary to conduct an expert evaluation before forming conclusions and implementing models in real applications. This paper considers the issue of creating and using prototypes of AI applications for research and proposes to use Gradio and Hugging Face to speed up this process.

Gradio is an open-source Python library that aims to quickly and easily build web applications for application demos, machine learning model testing, and any other Python code [3]. Gradio will enable developers to quickly create web applications without requiring deep knowledge of web development, providing them with many ready-made interface elements. Due to its ease of use and wide range of features, Gradio is a helpful tool for developers looking to quickly prototype and get feedback from users.

The advantages of Gradio include:



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- Python allows for fast development of web applications without the need to learn additional languages and technologies for UI;
- the availability of ready-made interface elements simplifies data input, output, and interaction with the program;
- the application launch is fast, takes a minimum of resources, and requires only the execution of a Python file.

In addition to the predefined input and output elements, Gradio provides the ability to add sample input data to your application. This feature is useful both at the development stage to always have test data at hand and can be helpful for users who may not understand what data they need to input or simply do not have the necessary data.

HuggingFace is a website that contains many machine-learning models of different types and various datasets of varying nature [5]. However, one of the platform's most interesting and popular services is HuggingFace Spaces. HuggingFace Spaces provides the functionality of hosting web applications created using the Gradio or Streamlit libraries. Both libraries are very similar in terms of their operation, but most users prefer Gradio due to the more significant number of functions. An application launched on HuggingFace Spaces can be easily shared with others, as it does not require any registration to use such applications. In addition, any other platform users will be able to use the created application without any obstacles. A Git repository is created for each created space. Using Git greatly simplifies the development process. Each time an update is made to the repository, the application is automatically restarted, which makes it easier to launch and update the application.

However, the most crucial advantage of HuggingFace Spaces is the free resources. The free resource package includes two virtual processor cores and 16 GB of RAM. This free configuration can be used for a large number of tasks that do not require significant computing.

The use of commercial language models from OpenAI, Google, Anthropic, and others is gaining popularity. Your application may also require some other API service. Such services often provide API keys to access their resources. Still, in the case of HuggingFace Spaces, the application code is public, so other people can easily see all the sensitive information, which is dangerous. For this reason, HuggingFace Spaces provides the ability to create Secrets in your spaces, which can be accessed from the code as environment variables, making the use of sensitive information in HuggingFace Spaces safe.

The combination of Gradio and HuggingFace provides many opportunities for creating web applications for various purposes and significantly simplifies the process of their development (Fig. 1).



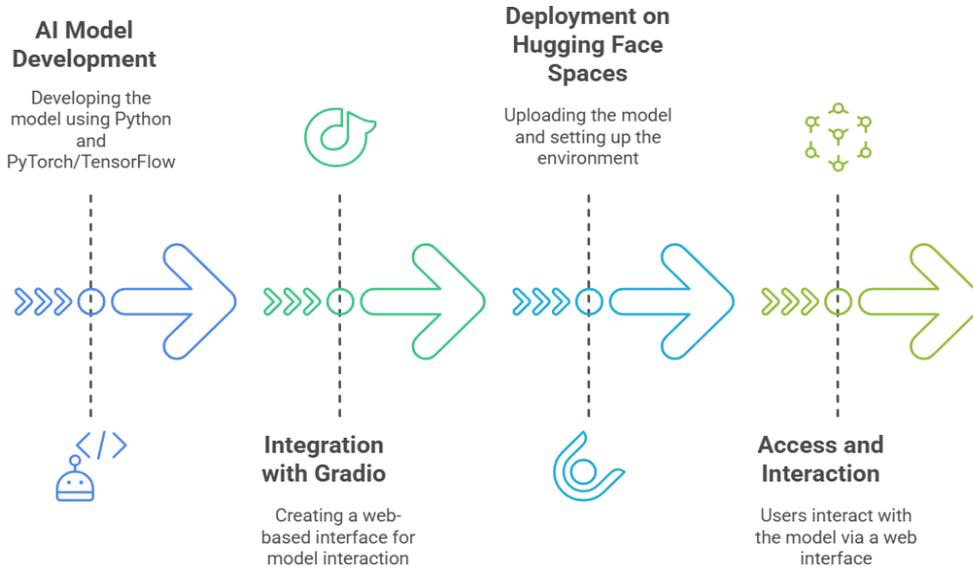


Fig. 1. **Process Flow for Developing, Integrating, Deploying, and Accessing an AI Model using Gradio and Hugging Face**

The advantages and disadvantages of combining Gradio with HuggingFace are shown in Table 1.

Table 1

Advantages and disadvantages of using Gradio and Hugging Face together

Advantages	Disadvantages
Ease of use	Limited interface settings
Fast integration	Limited number of free resources
A wide range of AI models	Limited work speed
Community support	

[author's development]

Examples of applications that can be created using Gradio include developing applications for idea validation or testing and creating demo applications. A very popular web application in the large language model community is Chatbot Arena [1], made with Gradio. The application is designed to test large language models, compare them, and make a rating based on this data.

There is another example to consider. Many language models may be suitable for the task of generating tests based on the text of books, but there is a possibility that the best one may not work well enough for this particular task. This case is precisely the scenario where Gradio is the best fit. With its help, an application can



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be created that will present several models where users can pass the same tests and leave feedback. The app can also be hosted on HuggingFace Spaces to distribute among people. Based on the collected statistics, choosing the best model and improving the algorithms will be possible. Compared to the time and effort that would have been spent creating the same app using other technologies and hosting it on other services, the combination of Gradio and HuggingFace Spaces is a significant win.

As of October 2024, Gradio has become a key player in the AI development ecosystem, with over 2 million monthly users and more than 470,000 applications built on the HuggingFace Spaces platform [4].

Conclusions. The use of Gradio and Hugging Face Spaces opens up new opportunities for the rapid development, testing, and deployment of AI applications, making these processes accessible even to developers without deep knowledge of web development. The combination of these tools saves time and resources and creates interactive applications that can quickly scale and receive feedback from users. Given the dynamic growth of the AI industry, Gradio and Hugging Face have become indispensable tools for research, prototyping, and implementing innovative solutions.

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