CAPSTONE PROJECT

PROJECT TITEL

Presented By:

1. Shubham Tiwari – Babasaheb Bhimrao Ambedkar Central University Lucknow
2. Department Name – B.sc Inofmation Technology
3. E-mail – st8605648@gmail.com

edunet foundation

OUTLINE

- **Problem Statement** (Should not include solution)
- **Proposed System/Solution**
- **System Development Approach** (Technology Used)
- **Result (Output Image)**
- **Future Scope**

PROBLEM STATEMENT

Problem statement 36: Tracking Maternal Health Progress Toward SDG 3.1: A Global Data Analysis The Challenge: The Sustainable Development Goal 3.1 aims to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030. Monitoring progress towards this goal requires analyzing country-wise data on maternal mortality and associated health indicators such as antenatal care coverage, births attended by skilled personnel, adolescent birth rates, and healthcare expenditures. Despite global efforts, maternal health outcomes vary drastically between regions and income groups, raising the need for data-driven insights into the factors influencing maternal health. AI Kosh dataset link: https://www.data.gov.in/resource/sustainable-development-goals-national indicator-framework-version-31-2021 Technology – Use of IBM cloud lite services is mandatory

PROPOSED SOLUTION

- Use Pixtral 12B for multimodal AI queries in Python with watsonx
- **Authors:** Anna Gutowska and Erika Russi
- In this tutorial, you will discover how to apply Mistral AI's Pixtral 12B multimodal model now available on watsonx.ai for multimodal tasks such as image captioning and visual question answering.
- Pixtral 12B
- In September 2024, Mistral AI launched Pixtral 12B, an open-source large language model (LLM) under the Apache 2.0 license.
- With 12 billion parameters, the multimodal model is built on Mistral AI's Nemo 12B LLM. Pixtral 12B has two components: the vision encoder to tokenize images and a multimodal transformer decoder to predict the following text token given a sequence of text and images. The vision encoder has 400 million parameters and supports variable image sizes.
- The model excels at multiple use cases, including understanding graphs, diagrams, charts and documents in high resolution, which may be used for document question answering, instruction following or retrieval augmented generation (RAG) tasks. Additionally, Pixtral 12B has a 128,000-token context window, which allows for the consumption of multiple images simultaneously.
- In terms of benchmarks, Pixtral 12B outperforms various models, including Qwen2-VL, Gemini-1.5 Flash 8B and Claude-3 Haiku. For certain benchmarks, including DocVQA (ANLS) and VQAv2 (VQA Match), the model outperforms OpenAI's GPT-4o and Claude-3.5 Sonnet.
- Besides being able to run Pixtral 12B on watsonx.ai, the model is also available via Hugging Face, on Le Chat, Mistral's conversational chatbot, or via API endpoint through Mistral's La Plateforme.

Step 2. Set up watsonx.ai Runtime service and API key

Create a watsonx.ai Runtime service instance (choose the Lite plan, which is a free instance).

Generate an API Key.

Associate the watsonx.ai Runtime service to the project you created in watsonx.ai.

Step 3. Install and import relevant libraries and set up your credentials

We'll need a few libraries and modules for this tutorial. Make sure to import the following ones; if they're not installed, you can resolve this with a quick pip install.

```
#installations%pip install image | tail -n 1%pip install -U
"ibm_watsonx_ai>=1.1.14" | tail -n 1
```

SYSTEM APPROACH STEP 3

- Requirement already satisfied: sqlparse>=0.3.1 in /opt/conda/envs/Python-RT24.1/lib/python3.11/site-packages (from django->image) (0.5.3) Note: you may need to restart the kernel to use updated packages. Requirement already satisfied: typing_extensions>=4.5 in /opt/conda/envs/Python-RT24.1/lib/python3.11/site-packages (from anyio->httpx<0.29,>=0.27->ibm_watsonx_ai>=1.1.14) (4.12.2) Note: you may need to restart the kernel to use updated packages.
-

Input your WATSONX EU APIKEY and WATSONX EU PROJECT ID that you created in steps 1 and 2 upon running the following cell. We will also set the URL serving as the API endpoint.

```
#importsimport requestsimport base64import getpassimport textwrapfrom PIL import Imagefrom
ibm_watsonx_ai import Credentialsfrom ibm_watsonx_ai.foundation_models import ModelInference


  WATSONX_EU_APIKEY = ("5t5C7vW4jHv7C0jaqMXN99ce8GR06tm8g-
  M_MopE5Lx")WATSONX_EU_PROJECT_ID = ("316661cb-d483-4579-904b-
  4884cada90ef")URL = "https://eu-gb.ml.cloud.ibm.com"

credentials = Credentials(    url=URL,
api_key=WATSONX_EU_APIKEY)
```

STEP 4

- Step 4. Encode images
- In this tutorial, we will be working with several images for multimodal AI applications such as image captioning and object detection. The images we will be using can be accessed using the following URLs. We can store these URLs in a list to iteratively encode them.
- url_image_1 = 'https://hsc.unm.edu/medicine/departments/dermatology/_images/skin-atlas/acne/acne-type-iv.jpg'url_image_2 = 'https://hsc.unm.edu/medicine/departments/dermatology/_images/skin-atlas/acne/acne-type-i.jpg'image_urls = [url_image_1, url_image_2]

STEP 5

- Step 5. Set up the API request and LLM
- Now that our images can be passed to the LLM, let's set up a function for our watsonx API calls. The augment_api_request_body function takes the user query and image as parameters and augments the body of the API request. We will use this function in each iteration.
-

```
def augment_api_request_body(user_query, image):    messages = [        {            "role": "user",            "content": [{                "type": "text",                "text": 'You are a helpful assistant. Answer the following user query in 1 or 2 sentences: ' + user_query            },            {                "type": "image_url",                "image_url": {                    "url": f"{image}",                }            }]        }    ]    return messages
```

```
model = ModelInference(    model_id="mistralai/pixtral-12b",    credentials=credentials,    pr
oject_id=WATSONX_EU_PROJECT_ID,    params={        "max_tokens": 200      })

model1 = ModelInference(    model_id="meta-llama/llama-3-2-11b-vision-instruct",    credentials=credentials,
project_id=WATSONX_EU_PROJECT_ID,    params={        "max_tokens": 200      })

for i in range(len(encoded_images)):       image = encoded_images[i]    user_query = "What kind of disease this person
is having, please suggest requred medcin?"    messages = augment_api_request_body(user_query, image)
        response = model.chat(messages=messages)       response1 = model1.chat(messages=messages)   print("<==
Response by Pixtral 12B model ==> ")    print(textwrap.fill(response['choices'][0]['message']['content'], width=100),"\n")
        print("<== Response by llama 11b vision-instruct model ==> ")
        print(textwrap.fill(response1['choices'][0]['message']['content'], width=100),"\n")
```

CONCLUSION

- Summarize the findings and discuss the effectiveness of the proposed solution. Highlight any challenges encountered during the implementation and potential improvements. Emphasize the importance of accurate bike count predictions for ensuring a stable supply of rental bikes in urban areas.

RESULT

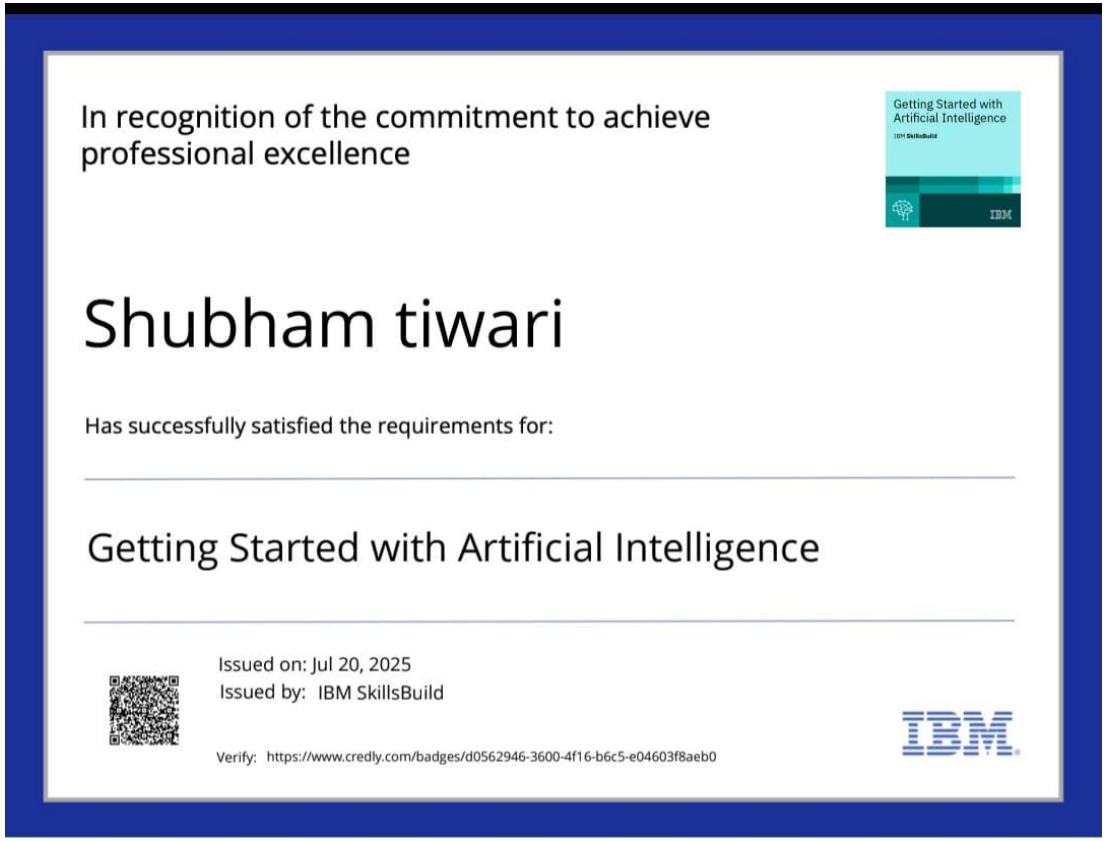
<== Response by Pixtral 12B model ==> The symptoms shown in the image resemble severe acne or possibly something more serious like Compétent syndrome. For precise diagnosis and treatment, a dermatologist should be consulted, and the patient may need prescription medication such as topical creams, antibiotics, or isotretinoin. <== Response by llama 11b vision-instruct model ==> The person in the image appears to have a skin condition, possibly acne or eczema, but it's difficult to determine the exact disease without more information. I'm not a medical professional, but I can suggest that the person may benefit from consulting a dermatologist for a proper diagnosis and treatment plan, which may include topical or oral medications such as retinoids, antibiotics, or corticosteroids. <== Response by Pixtral 12B model ==> The person in the image appears to have acne, characterized by numerous red bumps and lesions on the face. To treat acne, one could consider using over-the-counter topical creams with benzoyl peroxide or salicylic acid, or seek medical advice for more severe cases, which might require prescription medications such as antibiotics or isotretinoin. <== Response by llama 11b vision-instruct model ==> The person in the image appears to have acne, a common skin condition characterized by the presence of pimples, blackheads, and whiteheads. For acne, the required medication may include topical retinoids, benzoyl peroxide, or salicylic acid to help reduce inflammation and prevent future breakouts. However, it's essential to consult a dermatologist for a proper diagnosis and personalized treatment plan.

FUTURE SCOPE

- This app will play a very important role in the coming times of disease detection. It will be a benchmark for markets like India and will also help people.

IBM CERTIFICATIONS

- Screenshot/ credly certificate(getting started with AI)



IBM CERTIFICATIONS

- Screenshot/ credly certificate(Journey to Cloud)

IBM CERTIFICATIONS

- Screenshot/ credly certificate(RAG Lab)

THANK YOU

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