

# Cheat Sheet: Foundations of Multimodal AI

Concept	Description	Implementation Example
Image captioning	Generate descriptive captions for images using multimodal models.	<pre>def generate_image_caption(model, encoded_image):     """Generate a descriptive caption for an image."""     prompt = "Please provide a detailed description of this image."     return send_multimodal_query(model, encoded_image, prompt) # Example usage caption = generate_image_caption(model, encoded_image) print("Image Caption:", caption)</pre>
Image processing	Basic image processing and encoding for multimodal applications.	<pre>import base64 from PIL import Image from io import BytesIO def encode_image(image_path):     """Convert image to base64 for model input."""     with open(image_path, "rb") as image_file:         encoded_string = base64.b64encode(image_file.read()).decode('utf-8')     return encoded_string def process_image(image_path, target_size=(224, 224)):     """Process image for model input."""     image = Image.open(image_path)     image = image.resize(target_size)     return image # Example usage image_path = "example.jpg" encoded_image = encode_image(image_path) processed_image = process_image(image_path)</pre>
Multimodal model setup	Basic setup for working with multimodal AI models using IBM watsonx.ai platform.	<pre>from ibm_watsonx_ai import Credentials from ibm_watsonx_ai.foundation_models import ModelInference from ibm_watsonx_ai.foundation_models.schema import TextChatParameters credentials = Credentials(     url="https://us-south.ml.cloud.ibm.com", ) params = TextChatParameters(     temperature=0.2,     top_p=0.5,     max_tokens=2000 ) model = ModelInference(     model_id="meta-llama/llama-3-2-90b-vision-instruct",     credentials=credentials,     project_id="skills-network",     params=params )</pre>

Multimodal query	Send a combined text and image query to a multimodal model.	<pre>def send_multimodal_query(model, encoded_image, prompt):     """Send combined text and image query to model."""     messages = [         {             "role": "user",             "content": [                 {                     "type": "text",                     "text": prompt                 },                 {                     "type": "image_url",                     "image_url": {                         "url": f"data:image/jpeg;base64,{encoded_image}"                     }                 }             ]         }     ]     response = model.chat(messages=messages)     return response['choices'][0]['message']['content'] # Example usage response = send_multimodal_query(model, encoded_image, prompt) print("Model Response:", response)</pre>
Text processing	Basic text processing and prompt engineering for multimodal applications.	<pre>def create_prompt(image_description, user_query):     """Create a structured prompt for multimodal analysis."""     prompt = f"""     Analyze the following image and answer the question.     Image Description: {image_description}     User Query: {user_query}     Please provide a detailed response that:     1. Describes the image content     2. Answers the specific question     3. Provides relevant context     """     return prompt # Example usage image_desc = "A cat sitting on a windowsill" user_question = "What is the cat doing?" prompt = create_prompt(image_desc, user_question)</pre>

<b>Visual question answering</b>	Answer questions about image content using multimodal models.	<pre>def visual_question_answering(model, encoded_image, question):     """Answer questions about image content."""     prompt = f"Please answer the following question about the image: {question}"     return send_multimodal_query(model, encoded_image, prompt) # Example usage question = "What color is the cat in the image?" answer = visual_question_answering(model, encoded_image, question) print("Answer:", answer)</pre>
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