Chapter 15: Hands-on Activity: GAN Paint

15.1 Introduction

In this chapter, you will explore a hands-on activity using a powerful Artificial Intelligence tool known as **GAN Paint**. GAN stands for **Generative Adversarial Network**, a special kind of AI model that can generate realistic images, such as faces, landscapes, or even imaginary objects, from scratch.

GAN Paint is an interactive web tool developed by researchers at **MIT-IBM Watson AI Lab**. It allows users to modify and create images using artificial intelligence by simply drawing on parts of an image. This chapter helps students visualize how AI can create and edit images by learning the basic concept of GANs through GAN Paint.

15.2 Learning Objectives

By the end of this activity, you will be able to:

- Understand the concept of GANs (Generative Adversarial Networks).
- Experiment with AI-generated images using the GAN Paint tool.
- Observe how small edits can influence image generation.
- Appreciate how AI can assist in creative tasks like image design.

15.3 What is GAN (Generative Adversarial Network)?

GAN is a deep learning model introduced by Ian Goodfellow in 2014. It consists of two parts:

1. **Generator**

- Creates fake images based on input.
- Tries to make them look real.

2. **Discriminator**

- Examines images and tries to determine whether they are real or fake.
- Helps improve the generator by giving feedback.

These two components compete with each other (like a game), hence the term **"adversarial"**. Over time, the generator becomes so good that the images it produces look real to humans.

15.4 About GAN Paint

GAN Paint is a live web-based application that allows users to:

- Add objects like trees, doors, clouds, or windows to existing images.
- Use a paintbrush tool to interactively edit the image.
- See how GAN responds to different kinds of strokes and placements.

Website Link (if allowed in your e-book):

GAN Paint Interactive Tool

15.5 Materials Required

- Computer or Laptop with internet access.
- Web browser (Chrome or Firefox recommended).
- GAN Paint website (https://ganpaint.io/)

15.6 Activity Instructions: Step-by-Step

Step 1: Open GAN Paint

- Go to https://ganpaint.io/
- Wait for the tool to load a default image.

Step 2: Explore the Interface

- You will see an image (usually a building) on the left.
- On the right, there are options like **Add Tree**, **Add Door**, **Add Window**, etc.

Step 3: Use the Brushes

- Select a brush, for example: "Tree".
- Draw in the image area where you want a tree to appear.
- Instantly, GAN Paint will generate a realistic tree in that spot.

Step 4: Try Other Tools

- Add or remove doors, windows, clouds, and more.
- You'll notice GAN intelligently adjusts the surrounding image to match your edits.

Step 5: Experiment with Undo and Reset

- Use the **Undo** button to remove the last change.
- Use the **Reset** button to return to the original image.

15.7 Observations & Learning

- You don't need to be a good artist—GAN Paint understands the intent behind your drawing.
- The AI model fills in realistic details, such as shadows, textures, and object structure.
- This shows how powerful **AI is in understanding patterns and creativity**.

15.8 Concept Behind the Activity

This activity is built on **deep neural networks** that are trained on thousands of images. When you draw a tree, GAN Paint refers to all the tree images it has learned and generates a new one in the same style as the original picture.

This is an example of **Generative AI**, which creates content instead of just analyzing data.

15.9 Real-World Applications of GANs

- **Art & Design**: AI-generated paintings and product designs.
- **Fashion**: Designing new clothes by combining styles.
- **Architecture**: Visualizing buildings before construction.
- **Gaming**: Generating realistic environments and characters.
- **Medical Imaging**: Creating synthetic data for training doctors.

15.10 Teacher/Facilitator Note

- Encourage students to compare before and after images.
- Discuss how GAN is different from traditional editing tools.
- Invite students to brainstorm real-world uses of GAN-based apps.

15.11 Summary

In this hands-on chapter, we explored **GAN Paint**, a tool that lets us edit images using **Generative Adversarial Networks**. We learned how GANs work, saw them in action by modifying images, and understood the basic structure involving a Generator and a Discriminator.

This chapter offered a **visual and interactive experience** to help you appreciate how AI is not just for data science but also plays a role in creativity and imagination.
