Task 1

Handwritten digit recognition is a popular computer vision task where the goal is to develop a machine learning or deep learning model that can accurately identify and classify handwritten digits (0-9) from images. Here are the steps to create a handwritten digit recognition system:

1. **Data Collection**: Gather a dataset of handwritten digits. A common dataset for this task is the MNIST dataset, which contains 28x28 pixel grayscale images of handwritten digits. You can also collect your own dataset if needed.

2. **Data Preprocessing**:
   - Normalize the pixel values: Scale the pixel values to a range between 0 and 1 by dividing them by 255 (since the original images typically have pixel values in the range 0-255).
   - Flatten the images: Reshape the 2D images into 1D arrays, which can be used as input to machine learning models.

3. **Model Selection**:
   - Traditional Machine Learning: You can use classifiers such as Support Vector Machines (SVM), Random Forests, or k-Nearest Neighbors (k-NN) on the flattened image data.
   - Deep Learning: Utilize deep neural networks, such as Convolutional Neural Networks (CNNs), which have been very successful for image recognition tasks.

4. **Model Training**: Train your chosen model on the training portion of your dataset. Ensure you have a validation set to monitor model performance during training.

5. **Model Evaluation**: Evaluate the model's performance on a separate test dataset to assess its accuracy and generalization.

6. **Hyperparameter Tuning**: Fine-tune the hyperparameters of your model, such as learning rate, batch size, and architecture, to optimize performance.

7. **Deployment**: Once satisfied with the model's performance, deploy it in your application. You can use various deployment methods, such as web applications, mobile apps, or even embedded systems.

8. **Continuous Improvement**: Monitor the model's performance in real-world scenarios and update it as needed to maintain accuracy.

Here's an example using Python and TensorFlow/Keras to create a simple CNN for digit recognition on the MNIST dataset: