

Classification of Images Using Machine Learning

What is it?

It is the process of categorizing images into predefined classes using machine learning algorithms, often employing neural networks like Convolutional Neural Networks (CNNs).

How is it used?

1. Collect and preprocess images (resize, normalize, augment).
2. Train a model (usually CNN) on labeled image data.
3. Test the model with unseen data to evaluate accuracy.
4. Use the trained model to classify new images.

Techniques Involved:

1. Prepare Images:

- Resize and clean images.
- Add variations (flip, rotate) to increase data.

2. Feature Extraction:

- Let the model find patterns in images (like shapes or edges).

3. Choose a Model:

- Use algorithms like CNNs or simpler models like SVM.

4. Train the Model:

- Teach the model using labeled images.

5. Test the Model:

- Check how well it works on new images.

6. Improve and Use:

- Adjust and use the model in apps like healthcare or security.

Applications:

- Healthcare: Diagnosing diseases from scans.
- Security: Identifying faces for authentication.
- Environment: Monitoring deforestation using satellite imagery.
- Transportation: Lane and obstacle detection in self-driving cars.
- Social media: Tagging and organizing photos.

Why CNN over ANN?

- **Spatial features:** CNNs are better at handling spatial data like images due to convolutional layers that capture local patterns.
- **Efficiency:** CNNs reduce the number of parameters using shared weights, making them computationally efficient for image data.
- **Performance:** CNNs achieve higher accuracy in image classification due to hierarchical feature extraction.
- **Translation invariance:** CNNs detect features regardless of their position in the image, unlike ANNs.