Artificial Intelligence

From problem to model

Scope the problem

Use Who, What, Where and Why. For a recycling sorter: who sorts waste, what errors occur, where items are scanned, and why better sorting matters. Define an observable goal.

Acquire and explore

Collect labelled examples covering the intended conditions. Check labels, classes and missing values. Include different lighting, backgrounds and object positions for an image classifier.

Choose the task

Classification predicts a category such as paper or metal. Regression predicts a numeric quantity such as weight. Clustering groups similar examples without supplied class labels.

Separate the data

Fit model parameters on training data. Use validation data for model choices. Evaluate the chosen model on held-out test data. Keep near-duplicate images in the same split.

Quick check

A sorter learns using photos of metal on a blue mat and paper on a red mat. Why might it fail on a grey conveyor?

Answer Mat colour predicts the training label accidentally. Collect both classes on varied backgrounds and test on independent conveyor images.

Artificial Intelligence

Evaluation and domains

Read the confusion matrix

Choose a positive class first. TP is a correctly predicted positive. FP is a negative predicted positive. FN is a positive predicted negative. TN is a correctly predicted negative.

Calculate the metrics

For TP 8, FP 2, FN 4 and TN 16: accuracy = (8+16)/30 = 80%. Precision = 8/(8+2) = 80%. Recall = 8/(8+4), about 67%.

Choose a metric

If missing defective items is costly, look closely at recall for the defective class. If every alarm triggers an expensive manual inspection, also monitor precision.

Language and vision

A vision model works with image patterns. A language model works with language representations. Bag of words counts terms but loses word order: “dog bites man” and “man bites dog” have the same counts.

Quick check

Of 100 items, 95 are normal and 5 defective. A model always predicts normal. Find accuracy and recall for defective items.

Answer Accuracy is 95%. Defect recall is 0/5 = 0%. The model detects none of the items the inspection system is intended to catch.