

Multi Class Classification Problem

Dr. Kalidas Y., IIT Tirupati

68) key phrase... “One Hot Encoding”

- *Binary representation of yi*

- All but one are 1
- *Remaining all are 0*

Example 1

I am learning machine learning
The dictionary is [am, i, learning, machine]
one-hot-encoding for ‘am’ is [1,0,0,0]
one-hot-encoding for ‘learning’ is [0,0,1,0]
likewise...

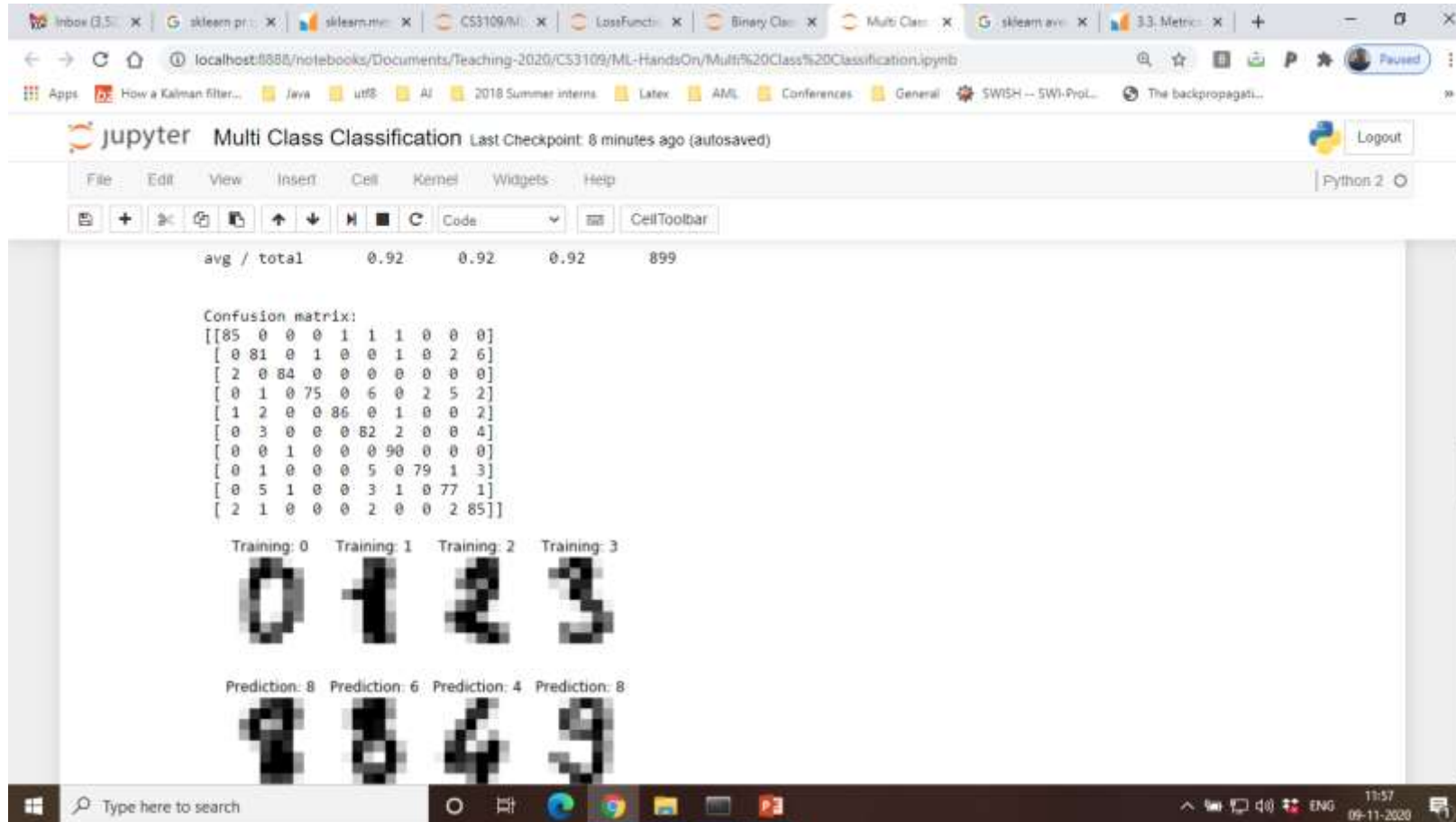
Example 2

If output is a category, e.g. ‘animal’, ‘person’,
‘bike’, ‘truck’
The dictionary is [‘animal’, ‘bike’, ‘person’, ‘truck’]
Then, one-hot-encoding for ‘animal’ is [1,0,0,0]
Then, one-hot-encoding for ‘person’ is, [0,0,1,0]
likewise

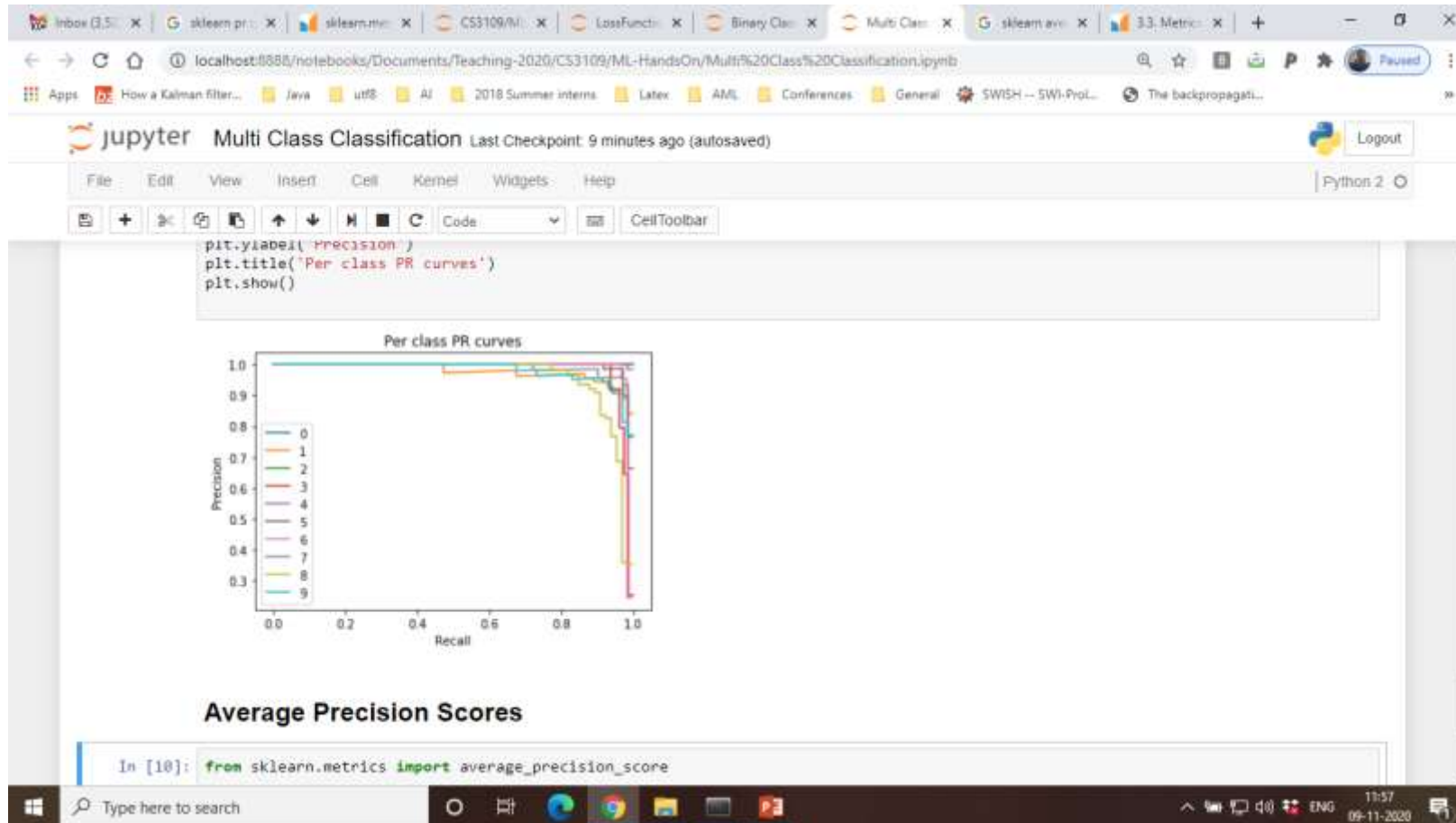
69) key phrase... “one-hot-encoder”

- Consider,
 - x_i k-dimensional input
 - y_i is m-dimensional output (in one-hot-encoding representation)
 - W is a transformation matrix (machine learning)
- model, $X_{N \times k} \times W_{k \times m} = Y'_{N \times m}$
- Data set $\{(x_i, y_i)\}_{i \in [1 \dots N]}$
- Loss function, is $L(W)$???
- *Deviation between prediction vector and the actual vector*
- **Prediction scores**, $y_{pred_scores} = W^T x_{new} \rightarrow$ followed by some transformations, we see!

Confusion Matrix



70) key phrase... “Class Specific PR Curve”



71) key phrase... “Mean Average Precision”

The screenshot shows the scikit-learn documentation page for `average_precision_score`. The page includes a sidebar with navigation links (Prev, Up, Next), the scikit-learn logo, version information (0.23.2), and a citation notice. The main content area describes the function's purpose: to compute average precision (AP) from prediction scores. It explains that AP summarizes a precision-recall curve as the weighted mean of precisions achieved at each threshold, with the increase in recall from the previous threshold used as the weight. A mathematical formula for AP is provided:
$$AP = \sum_n (R_n - R_{n-1}) P_n$$
 where P_n and R_n are the precision and recall at the n th threshold. The text notes that this implementation is not interpolated and is different from computing the area under the precision-recall curve with the trapezoidal rule. A note specifies that this implementation is restricted to the binary classification task or multilabel classification task. A link to the User Guide is provided. The Parameters section lists `y_true` as an array with shape `[n_samples]` or `[n_samples, n_classes]`, representing true binary labels or binary label indicators. The page also features a search bar and a 'Toggle Menu' button.

sample_weight=None [source]

Compute average precision (AP) from prediction scores

AP summarizes a precision-recall curve as the weighted mean of precisions achieved at each threshold, with the increase in recall from the previous threshold used as the weight:

$$AP = \sum_n (R_n - R_{n-1}) P_n$$

where P_n and R_n are the precision and recall at the n th threshold [1]. This implementation is not interpolated and is different from computing the area under the precision-recall curve with the trapezoidal rule, which uses linear interpolation and can be too optimistic.

Note: this implementation is restricted to the binary classification task or multilabel classification task.

Read more in the [User Guide](#).

Parameters: `y_true` : array, shape = `[n_samples]` or `[n_samples, n_classes]`
True binary labels or binary label indicators.