

Università degli
Studi di Milano-Bicocca



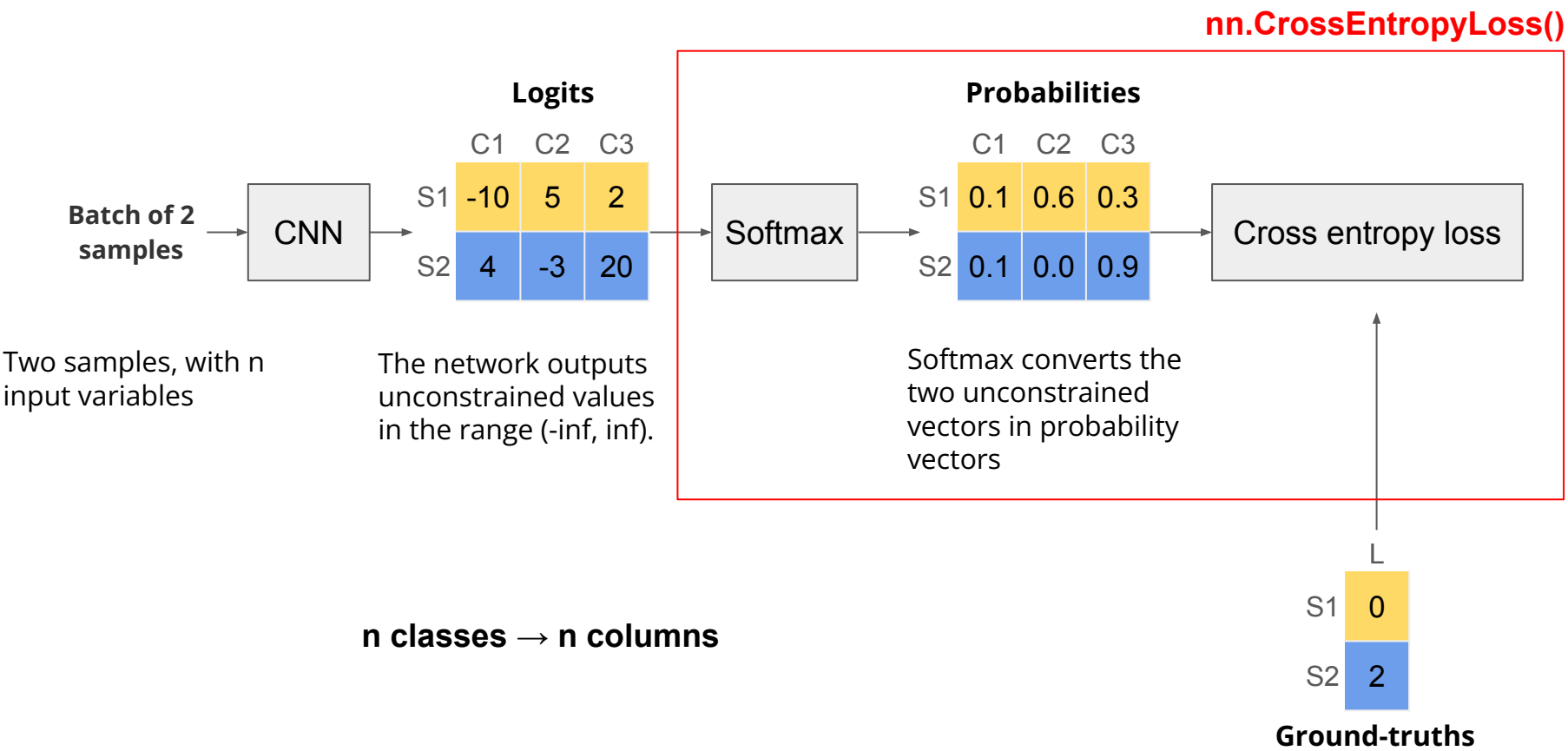
Classification with 1D-CNNs

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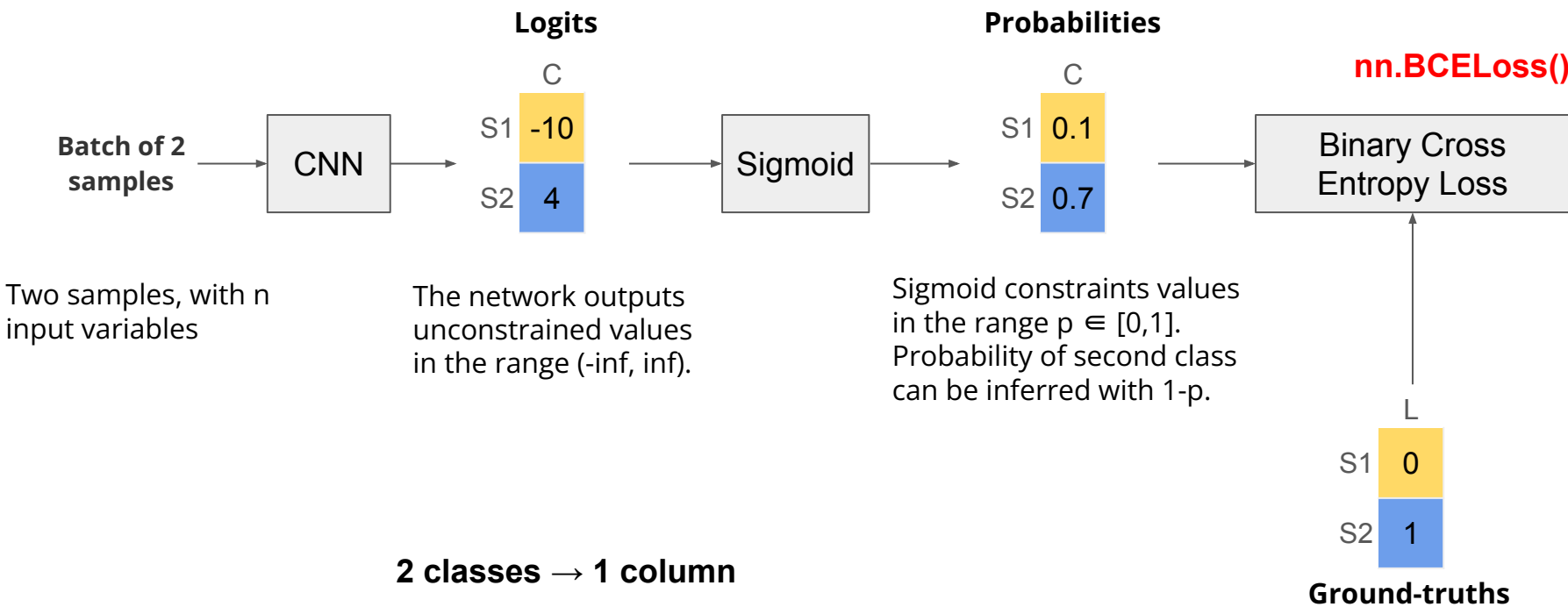
Multiclass classification

In Pytorch, you can use directly `nn.CrossEntropyLoss` which combines softmax and cross entropy loss



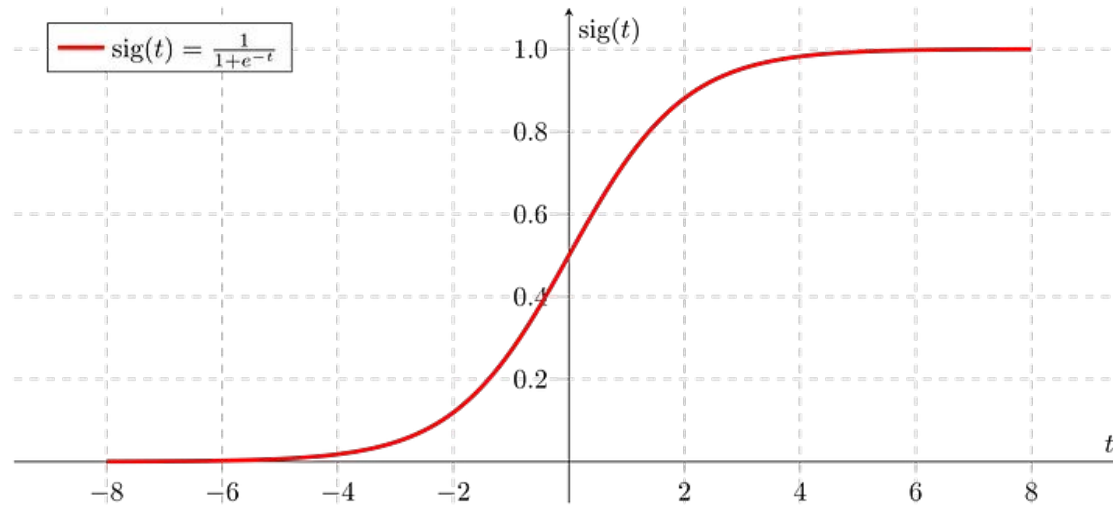
Binary class classification

Binary classification requires



Sigmoid

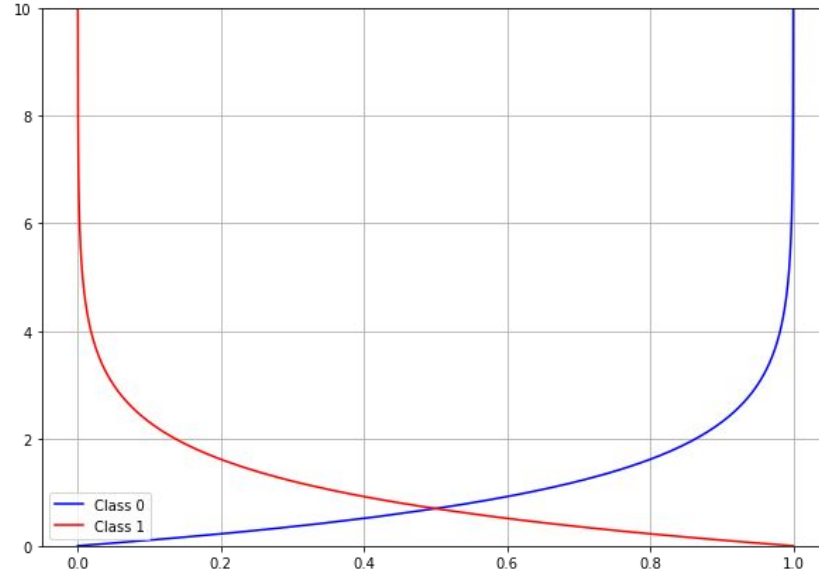
- The sigmoid function projects any value in the range $[0,1]$
- Very useful in binary classification tasks



Binary Cross-Entropy Loss

- In binary classification, the network outputs a single element **p**.
- To perform cross entropy, it's needed to slightly change the equation:

$$L_{BCE} = -\frac{1}{N} \sum_{i=1}^N \boxed{y_i \log(p(y_i))} + \boxed{(1 - y_i) \log(1 - p(y_i))}$$



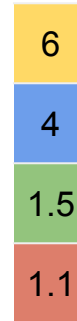
Pooling

- Pooling computes the average/max of the features in a neighbourhood
- It is applied channel-by-channel
- Useful to decrease spatial dimension

Current Activation

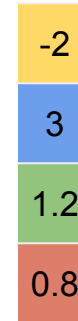


Max Pooling



$$y_{ijk} = \max_{pq \in \Omega_{ij}} x_{pqk}$$

Average Pooling



$$y_{ijk} = \text{avg}_{pq \in \Omega_{ij}} x_{pqk}$$

The heartbeat signal

The heart rate

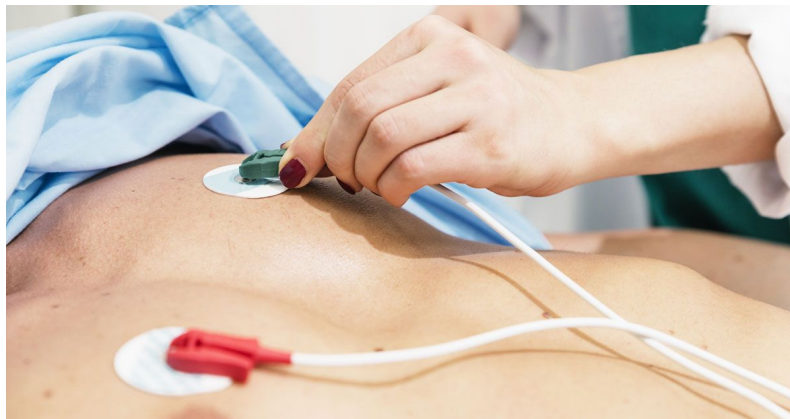


Heart rate (or pulse rate)

is the frequency of the heartbeat measured by the number of contractions of the heart per minute (beats per minute, or bpm)

Heart rate monitor

is the device used to measure the heart rate. Two different approaches:



Electrical (electrocardiography): Your heart generates a small electrical current with every heartbeat.



Optical (photoplethysmography): These devices use infrared light to see the expansion of your arteries as your heart pumps blood through them

Arrhythmia (irregular heartbeat)



DEF: Arrhythmia, or irregular heartbeat, is a problem with the rate or rhythm of your heartbeat. Your heart may beat too quickly, too slowly, or with an irregular rhythm.



Exercise 2 - Arrhythmia detection



Given a set of heart signals, determine whether the patient has arrhythmia or not.

- On e-learning you will find:
 - the csv dataset
 - few lines of code needed to load the data in a proper way