Università degli
Studi di Milano-Bicocca

# Classification with 1D-CNNs + heartbeat signal

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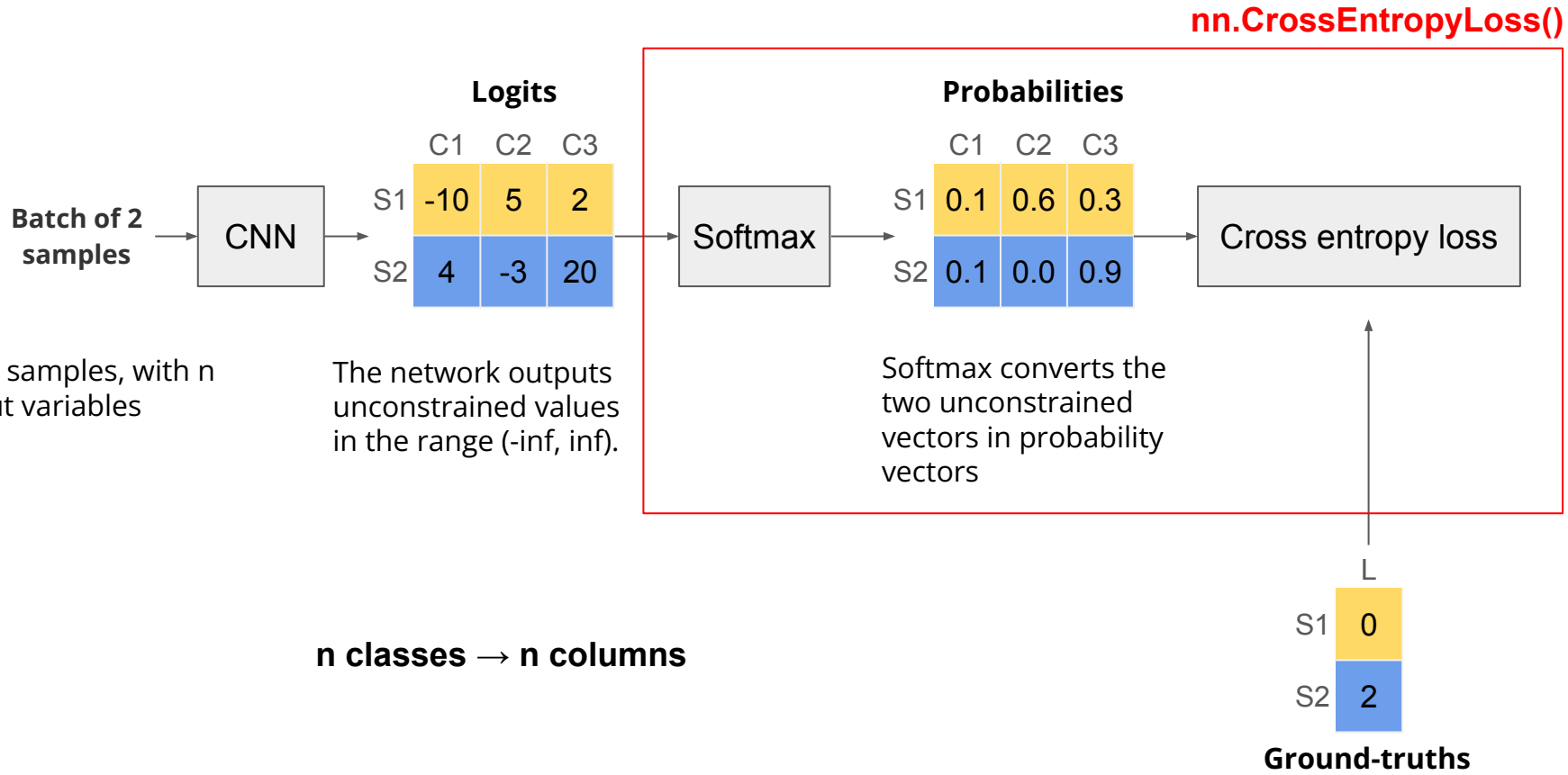
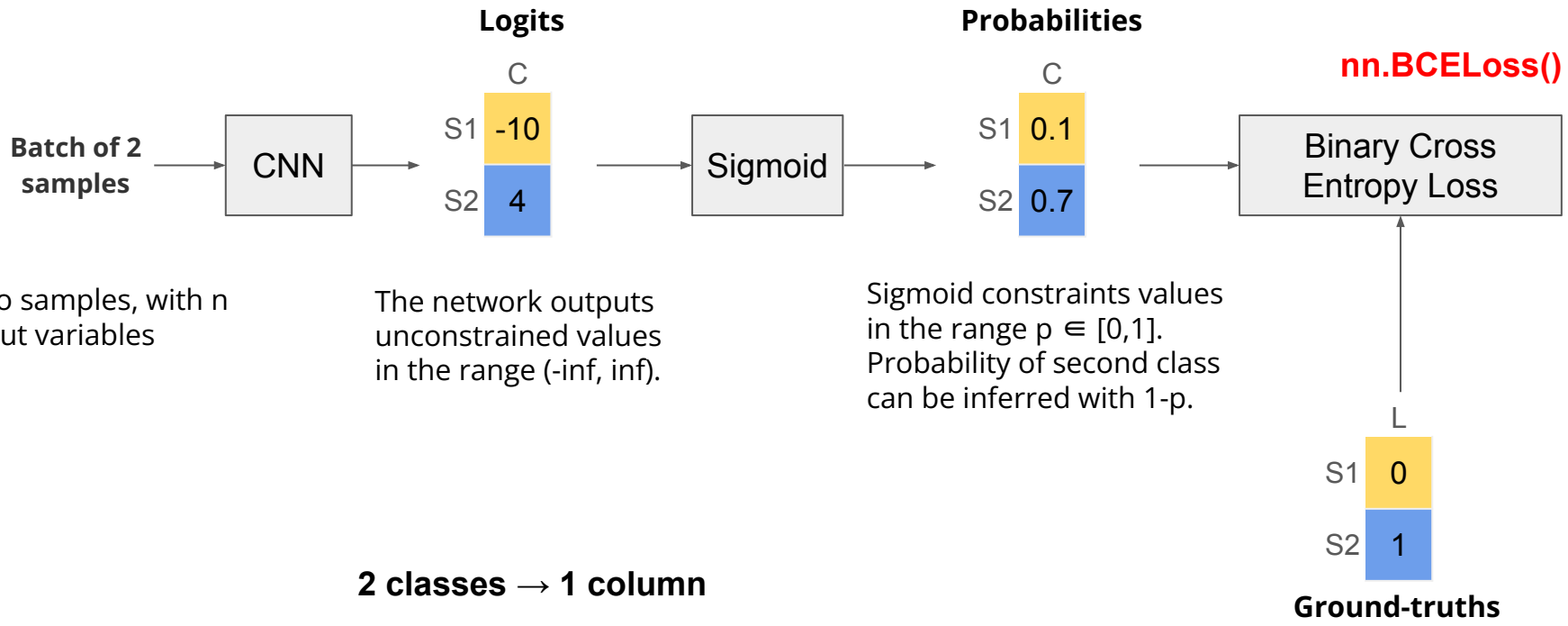
# Multiclass classification

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



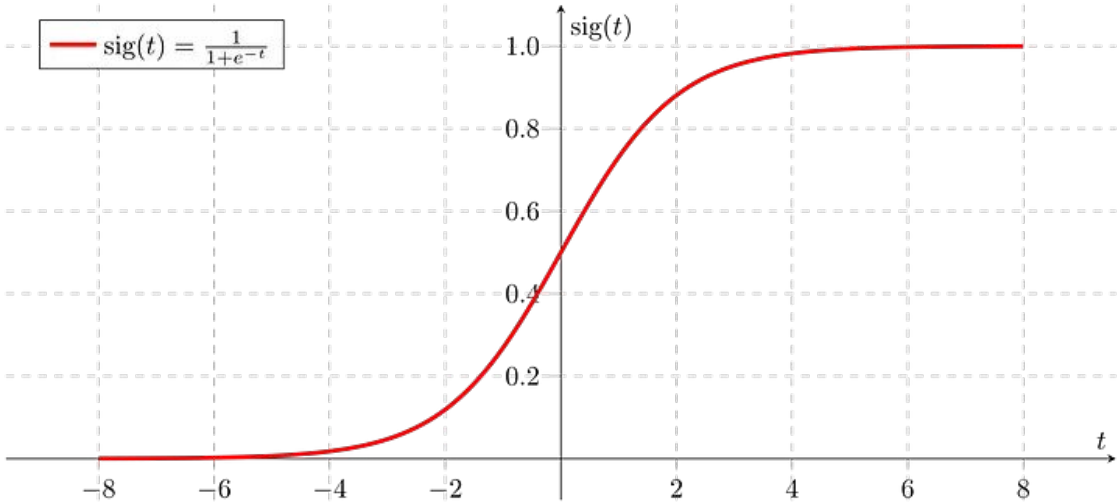
# Binary class classification

Binary classification in PyTorch requires that you constrain the network's output between 0 and 1.



# Sigmoid

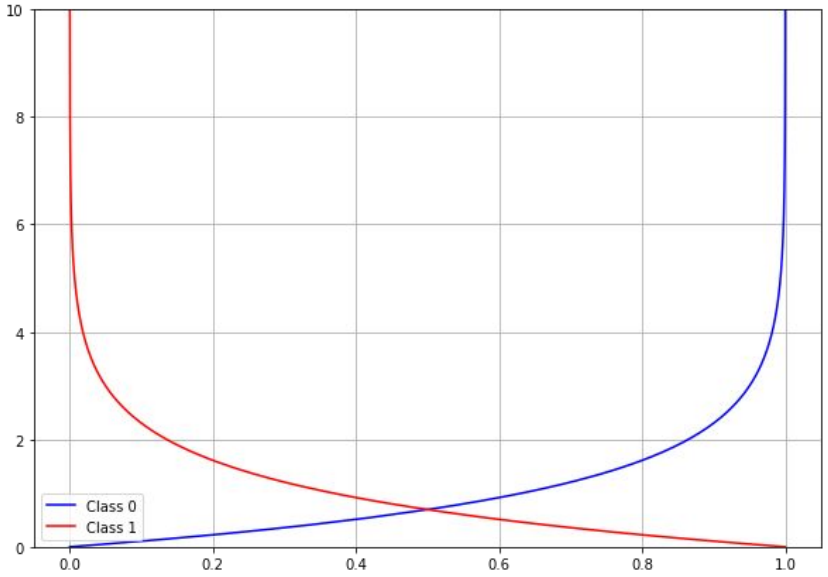
- The sigmoid function projects any value in the range [0,1]
- Very useful in binary classification tasks



# Binary Cross-Entropy Loss

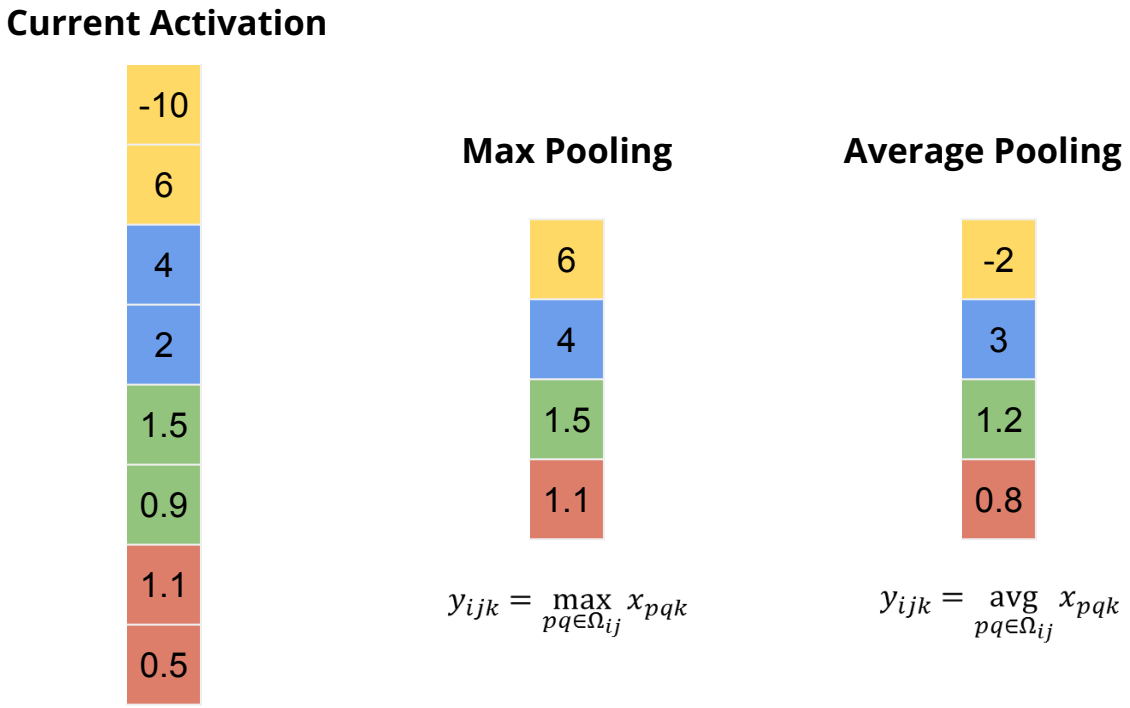
- In binary classification, the network outputs a single element **p**.
- To perform cross entropy, it's needed to slightly change the equation:

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



# Pooling

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



# 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