QoT estimation
Task 7

- What happens with the margin if some features are not known precisely?
- E.g., span lengths are decided at network design phase but the actual values in the field may be slightly different
- Ref paper:

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How Uncertainty on the Fiber Span Lengths Influences QoT Estimation Using Machine Learning in WDM Networks

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QoT estimation

Task 7

7. Evaluate the impact of uncertain fiber span length
   a) Define function *extract_UNCERTAIN_features()* (take inspiration from function *extract_features()* in task 2a), that generates span length features **with a random error chosen in a normal distribution with 0 mean and std dev *sigma* passed in input**
      - See details in the skeleton code

Hints:

To obtain the new dataset with features including the error, you should define new span lengths:

$$new\ span\ length = old\ span\ length + error$$

where

$$error = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x}{\sigma}\right)^2}$$

QoT estimation

Task 7

7. Evaluate the impact of uncertain fiber span length
   b) Consider NN algortihm only and redo training and performance evaluation using a new dataset with uncertain features, where error in span length is introduced with std dev = to 5%, 10%, 15% of the maximum span length across all lightpaths. Specifically, after reading the dataset (task 1b), for each error std dev, the steps are:
      - generate features matrix (new function from task 7a)
      - scale, split the dataset and train a new NN (task 3b)
      - predict and evaluate performance (task 6b)

QoT estimation

Task 7a)-b): expected outputs

5%*max_span_length

****
Total number of iterations: 1750
Current loss: 0.064
Best loss: 0.064
Training time [s]: 5.429
Final training R2 score is: 0.971
Final training MSE is: 0.128
****
MSE: 0.12 dB

Max error: 1.28 dB

Minimal margin to avoid disruptions 1.0 dB

Error histogram
-1.1 dB: 1 times
-1.0 dB: 1 times
-0.7 dB: 1 times
…

10%*max_span_length

****
Total number of iterations: 1750
Current loss: 0.064
Best loss: 0.064
Training time [s]: 5.429
Final training R2 score is: 0.971
Final training MSE is: 0.128
****
MSE: 0.12 dB

Max error: 1.28 dB

Minimal margin to avoid disruptions 1.0 dB

Error histogram
-1.1 dB: 1 times
-1.0 dB: 1 times
-0.7 dB: 1 times
…

15%*max_span_length

****
Total number of iterations: 1750
Current loss: 0.069
Best loss: 0.069
Training time [s]: 8.025
Final training R2 score is: 0.969
Final training MSE is: 0.137
****
MSE: 0.13 dB

Max error: 1.34 dB

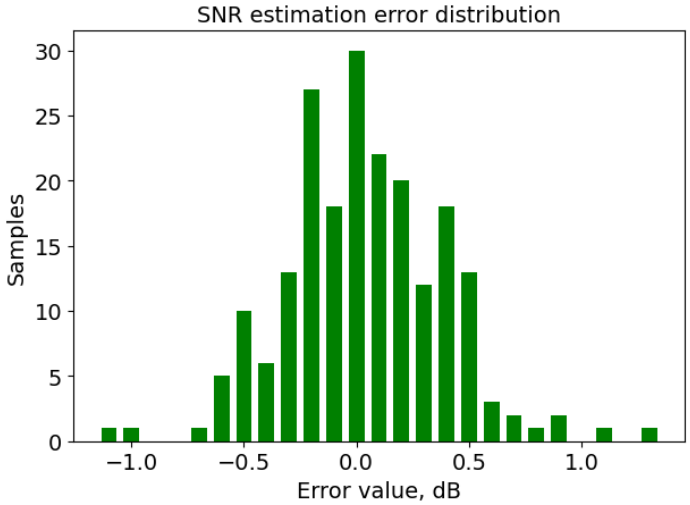
Minimal margin to avoid disruptions 1.0 dB

Error histogram
-1.1 dB: 1 times
-1.0 dB: 1 times
-0.7 dB: 4 times
…

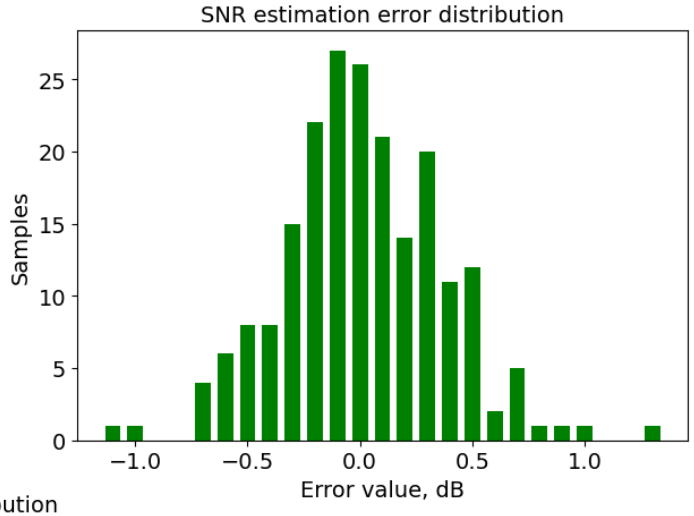
QoT estimation

Task 7a)-b): expected outputs

5%*max_span_length



15%*max_span_length



10%*max_span_length