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RMET Project

Part a. Reliability of DEBE Feedback

For checking the reliability of DEBE feedback and finding the **breakdown point** (number of samples at which sample data does not match very well with actual data), we have done both a *Qualitative* as well as *Quantitative* analysis of the given datasets.
In order to understand how well a curve derived from 'n' samples matches the curve derived from all samples combined we calculated the **SSE (Sum of Squares of Error)** for each sample.

Methods

Quantitative Analysis

The algorithm followed is explained as follows:

N = Total number of students

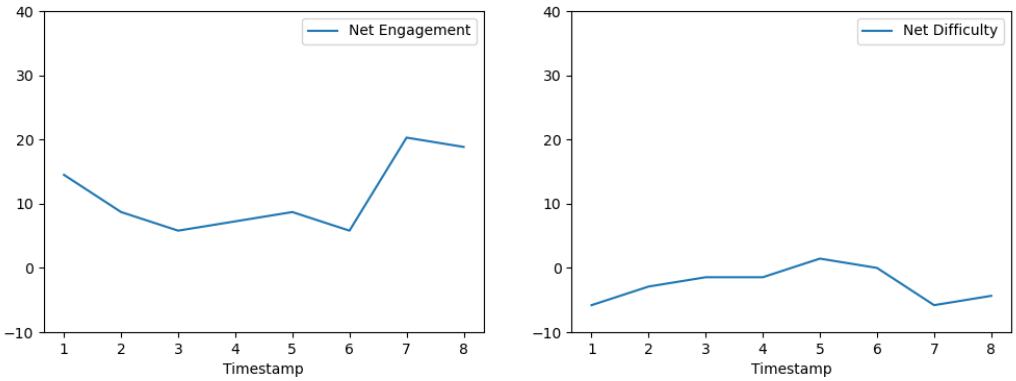
1. *FOR* n = N to 10
    a. FOR I = 1 to 100
        i. Randomly select 'n' student sheets (without replacement)
        ii. Consolidate all the readings from the 'n' selected student sheets
        iii. Apply moving window average (window size = 2) on the consolidated data frame
        iv. Calculate "Net Engagement" and "Net Difficulty" (in form of percentage)
        v. Calculate the SSE for each data frame (comparing the curve with n=N)
    b) Plot envelope curve for each 'n'
    c) n = n - 4
2. Plot box plot for each 'n' to compare the results side-by-side.

Qualitative Analysis

For each 'n' (number of samples), we run 100 iterations. All the 100 curves hence obtained are plotted on the same graph in order to obtain an **envelope** which is then visually compared with the ideal **Net Engagement** and **Net Difficulty** curves to see if the peaks and troughs are similar.

Dataset 1 (Segmentation and Paging Analysis)

For the first data set, there were a total 69 students' feedback data made available. We downsampled the feedback data from n=69 to n=15, reducing *n at intervals of 5*. For the first data set, the net engagement and net difficulty curves (at n = 69) look like the following:



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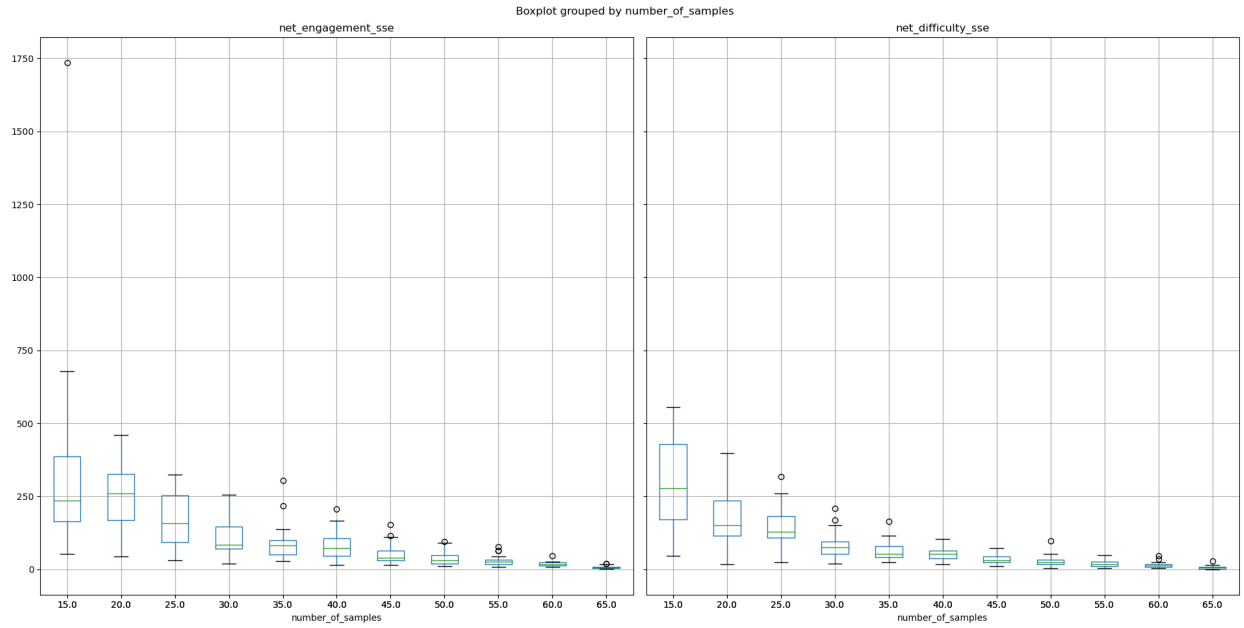
For Dataset 1, The given boxplot below plots the SSE calculated for each of the sample graphs given above. SSE has been calculated to quantify how well the original curve is matched by the sample curve.

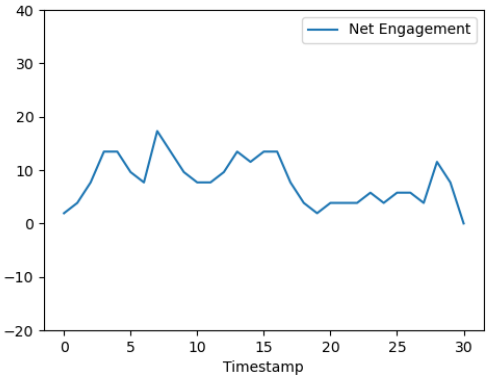


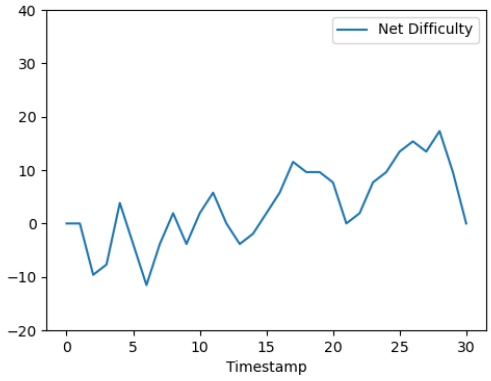
We can see a large variance in the SSE values plotted when n is less than 30. Between 30 and 40, the SSE variance and mean is small which means the sample curves partially match the original curve. Hence we have verified that DEBE breakdown occurs between 30-40 for this particular dataset.

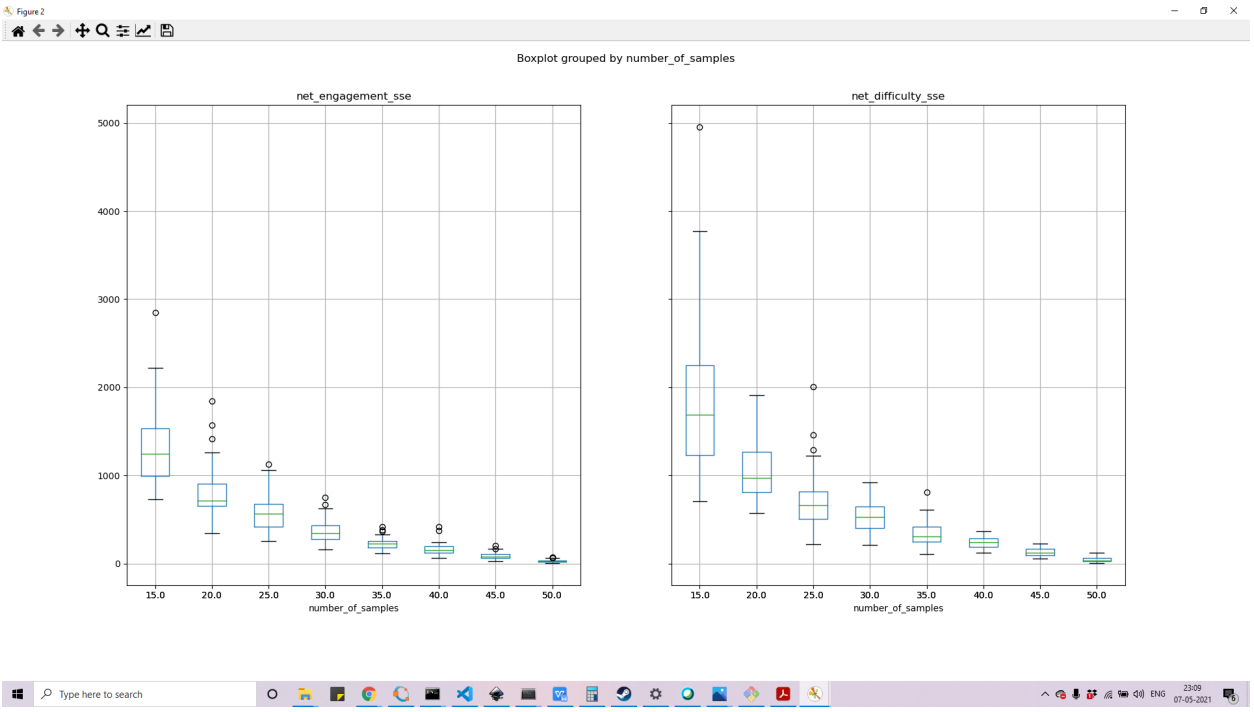
We have obtained the sample graphs (https://github.com/abh33/ResearchMethods-Project2/tree/master/Sample_Graphs_Segmentation) . From these graphs we can see that the morphology of the envelope of the sample graphs begins to deviate a lot from the actual net engagement and net difficulty curves at n = 40. Below n=30, the sample graphs are a poor representation of the actual curve. Hence we can say that DEBE breakdown happens between the range of 30-40 for this dataset

Dataset 2 (Java)

For the second data set, there were a total 52 students' feedback data made available. We downsampled the feedback data from n=50 to n=15, reducing *n at intervals of 5*. For the second data set, the net engagement and net difficulty curves (at n = 52) look like the following:







For Dataset 2, we have obtained the following sample graphs (https://github.com/abh33/ResearchMethods-Project2/tree/master/Sample_Graph_Java)

(DEBE point of breakdown occurs at around n = 25/30)

Part b. Noise/Data Augmentation

Dataset - JAVA

Nature of clicks:

1. Random clicking of Difficult / Easy and/or Engaging / Boring at regular intervals in into the lecture (roughly 5-6 mins)
2. 2 random clicks, one at the start of the lecture and one at the end
3. Clicking both Difficult and Easy or Engaging and Boring or ALL within the same instance

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Dummy Students with *noisy* clicks: 6 students (10% of class strength)

Methodology: Graphs were plotted for the original (verify the plots given in the description) as well as by added data augmentation (noise)
It was observed that:

- An additional crossover point is encountered between 11-12 min
- Rest details are replicated with slight shifts in Net Engagement
- The data can hence be called reliable

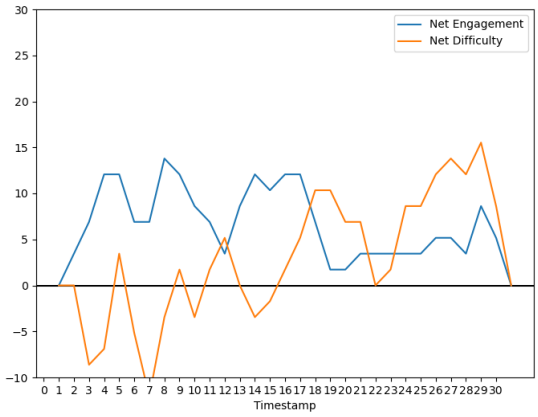

Fig.: DEBE Feedback after added noise (n=58)

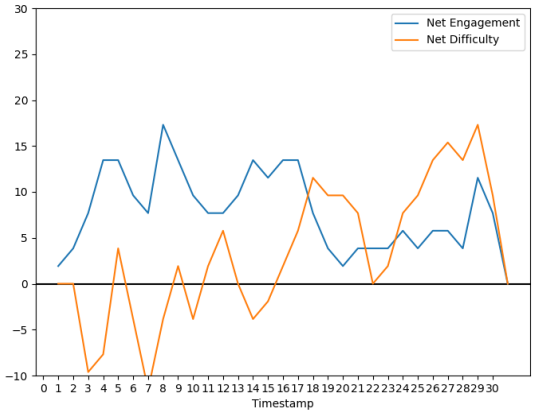

Fig.: DEBE Feedback before added noise (n=52)

Dataset - Page Segmentation

Nature of clicks:

1. Pressing only *Difficult* or *Boring*, during the just the first 60 seconds of the video
2. A few random clicks, at the start of the lecture and at the end (video drag)
3. Pressing only *Difficult* randomly during the course of the video

Dummy Students with *noisy* clicks: 9 students
Methodology: Graphs were plotted for the original (verify the plots given in the description) as well as by added data augmentation (noise)
It was observed that:

- Net difficulty level between 1.5 and 4 min is slightly higher (more difficult)
- Net Engagement curve follows the same pattern (albeit with a slight negative shift towards x-axis)

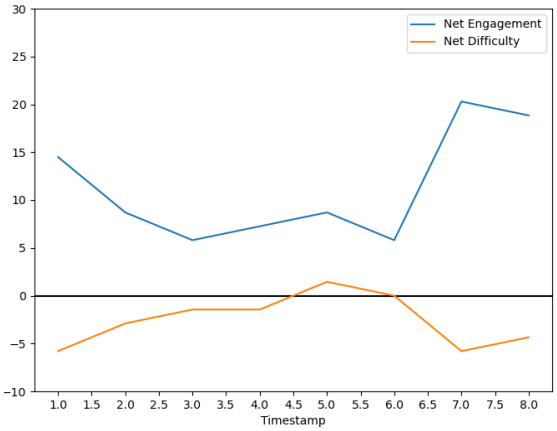

Fig.: DEBE Feedback before added noise (n=69)

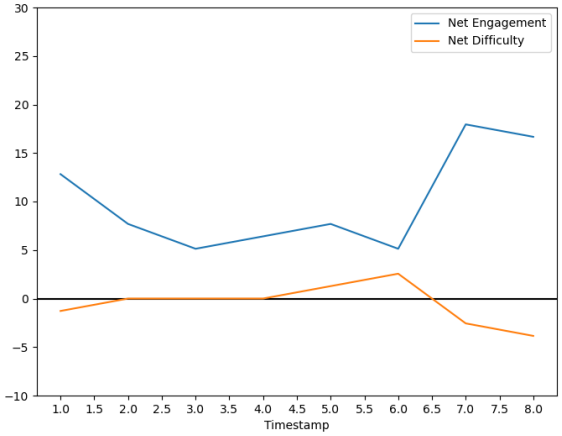

Fig.: DEBE Feedback after added noise (n=78)

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Appendix A: Code Files

https://github.com/abh33/ResearchMethods-Project2

Appendix B: Repository of Images

https://github.com/abh33/ResearchMethods-Project2/tree/master/Sample_Graphs_Segmentation
https://github.com/abh33/ResearchMethods-Project2/tree/master/Sample_Graph_Java