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Low-rankness of the data matrix

- Use the ultra chat dataset.
- Use first 1000 chats (45000 sentences) as the input.
- Use n-gram model to generate the sentence vectors in the form of sparse matrix **M**.
- Use svd to see the singular values of the first 2000 column of **M**. (Due to the limitation of memory, we can only use the first 2000 columns.)

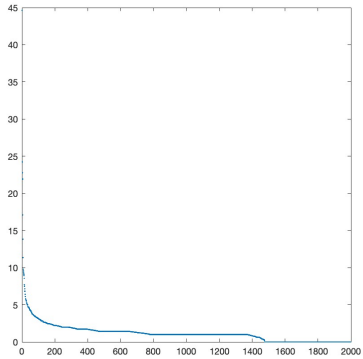

Figure: Singular values of the first 2000 columns of **M**

Low-rank adaptation of large language models
Intrinsic dimensionality explains the effectiveness of language model fine-tuning

- The weight matrix may not be low-rank, but the fine-tuned difference matrix is low-rank.
- The first one proposed a method $W' = W + \Delta W = W + BA$ to approximate the fine-tuned difference matrix.
- The second one proposed new interpretation of intrinsic dimensionality, which is the minimal description length of the fine-tuning task within the framework of the pre-trained model. Under this interpretation, the paper demonstrates how the process of pre-training implicitly optimizes the description length over the average of NLP tasks, even though the pre-trained model does not have direct access to those same tasks.