Efficient Transformers for Financial Data

Final Project of
MODELS OF
SEQUENTIAL DATA

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PLAN

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Introduction

- Financial Data - information about receipts and expenditures on a bank card

  => **predict client's gender**

  by 3 models: **Baseline, Performer** & **Informer**

- Comparing the efficiency of them in terms of *memory* and *computation.*

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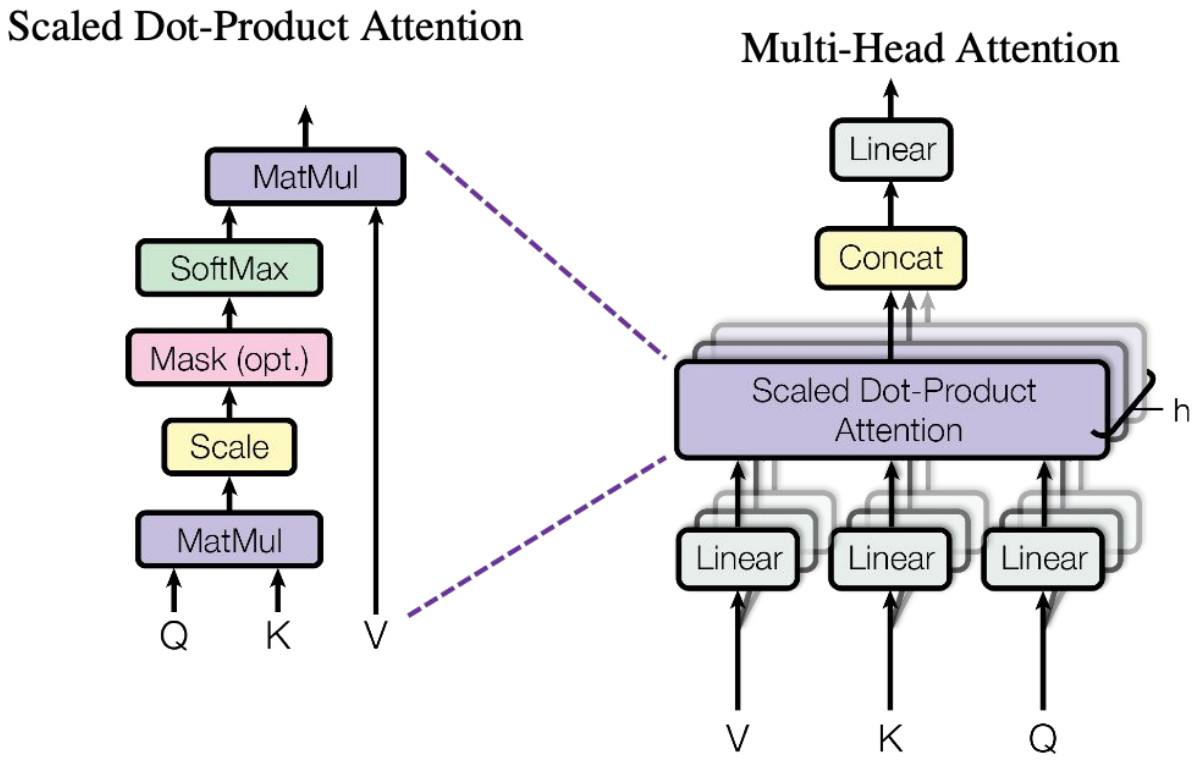
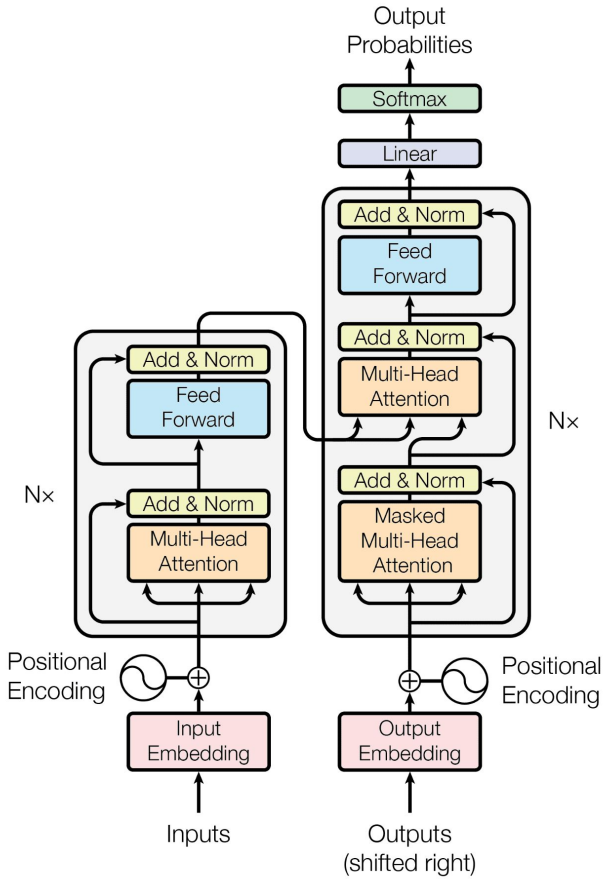
Full Attention Model





$$\text{MultiHead}(Q, K, V) = \text{Concat}(\text{head}_1, ..., \text{head}_h)W^O$$

$$\text{where head}_i = \text{Attention}(QW_i^Q, KW_i^K, VW_i^V)$$

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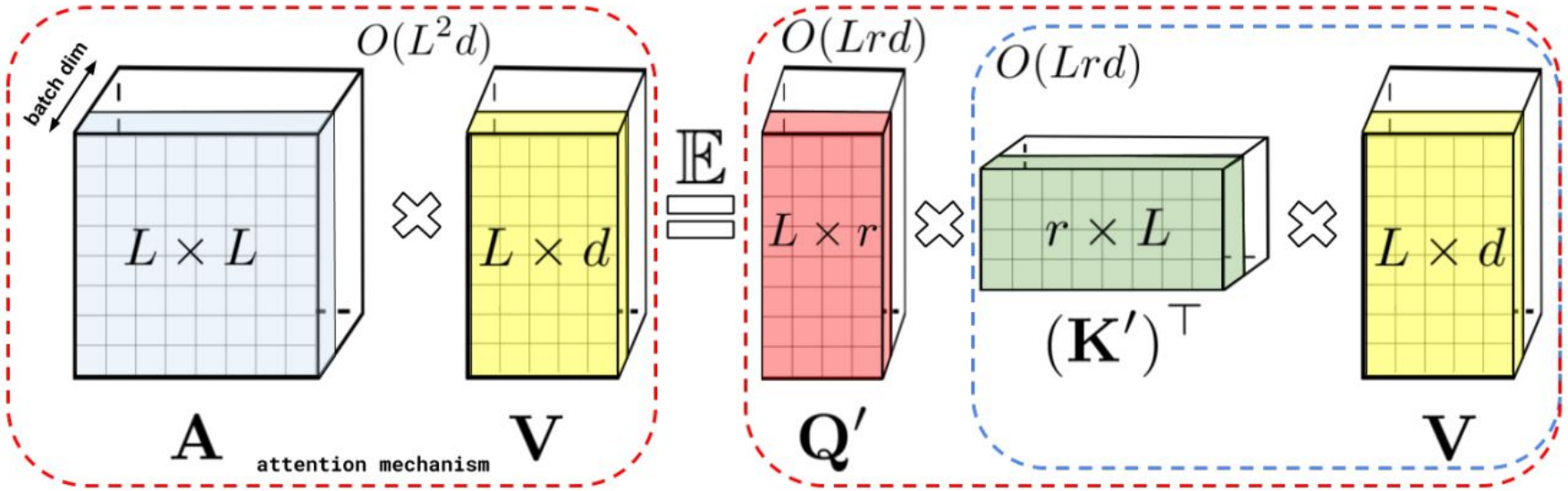
Performer Model



$$\phi(\mathbf{x}) = \frac{h(\mathbf{x})}{\sqrt{m}}(f_1(\omega_1^\top \mathbf{x}), ..., f_1(\omega_m^\top \mathbf{x}), ..., f_l(\omega_1^\top \mathbf{x}), ..., f_l(\omega_m^\top \mathbf{x})),$$

- Based on FAVOR+
- New space complexity O(Lr + Ld + rd)
- New time complexity O(Lrd)
  where L – sequence length, r – latent dimension size, d – embedding size

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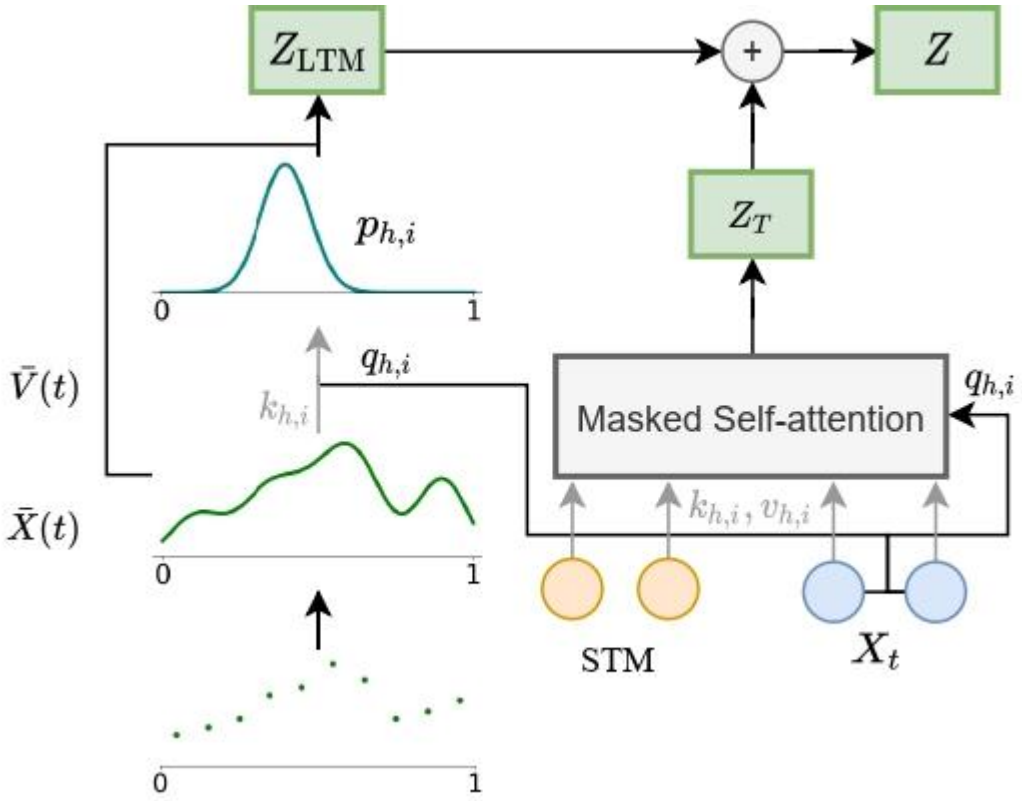
Informer Model

Main points:

- Continuous state representation:
  - convert input sequence in the continuous signal as linear combination of N radial basis functions via regression
  - add attention: also continuous via probability distribution computing by neural network
- Advantages:
  - Complexity will be linear O(LN) rather than quadratic $O(L^2)$
  - “Constant length” N which can be smaller than original L



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Informer Model

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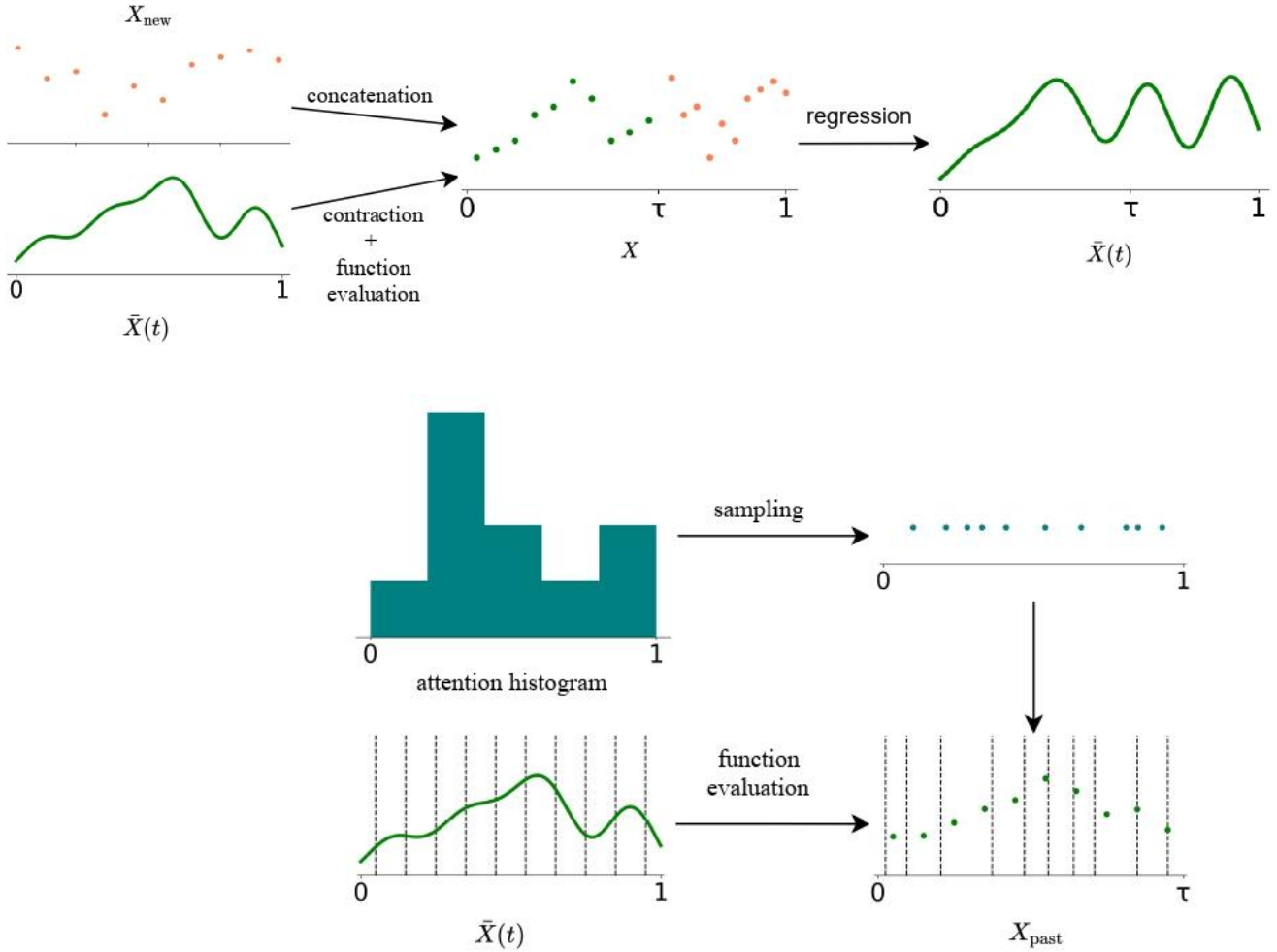
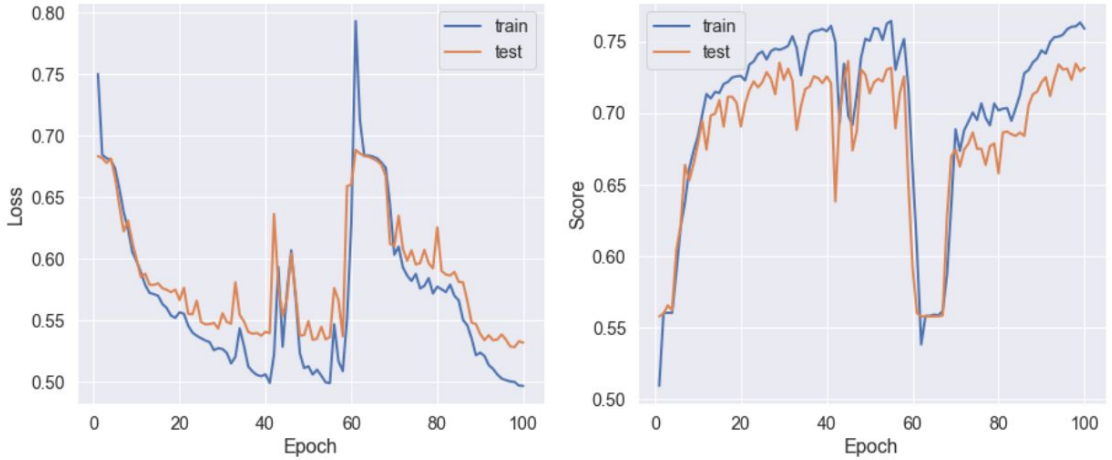
Additional points:

- unbounded memory: we can add points from previous continuous space representation
- sticky memories: sample according to previous attention

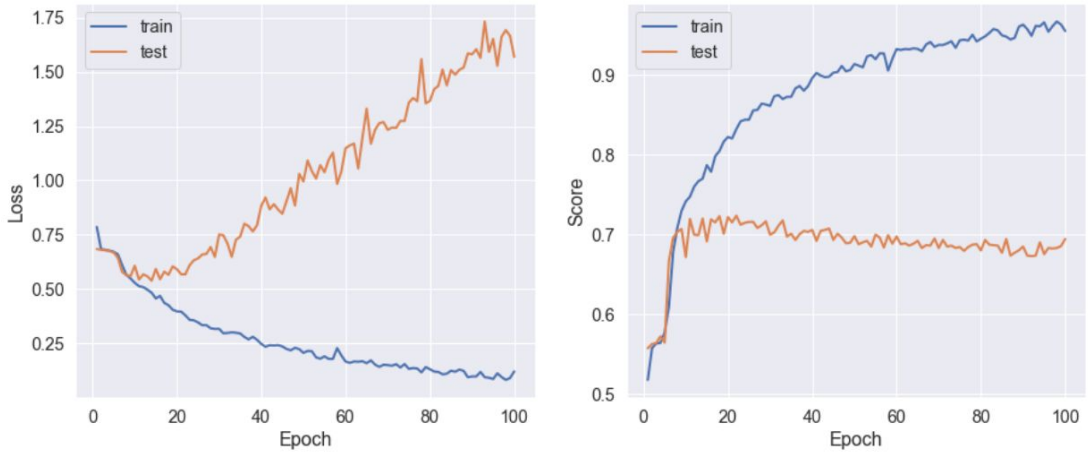


Results of training

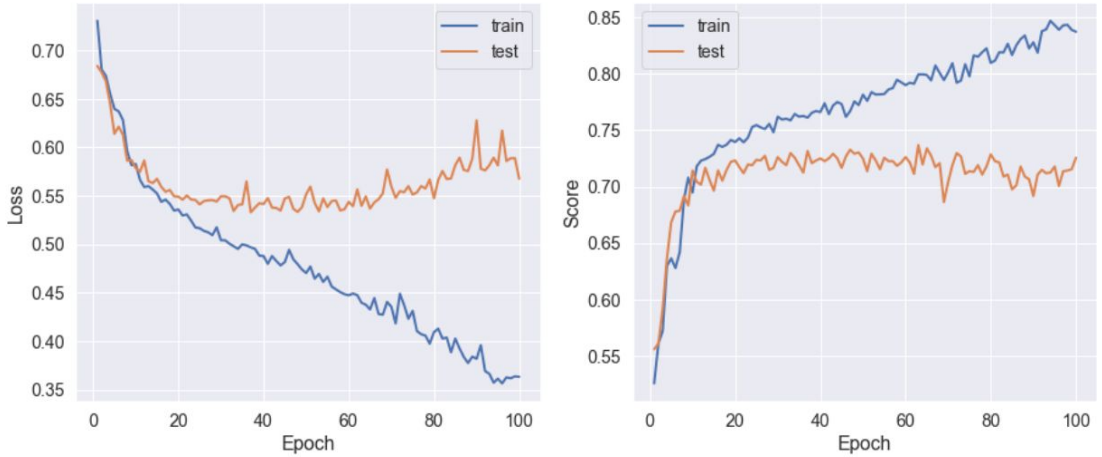
All the models achieve at least 70% accuracy score on the test data



pic.1.Performer

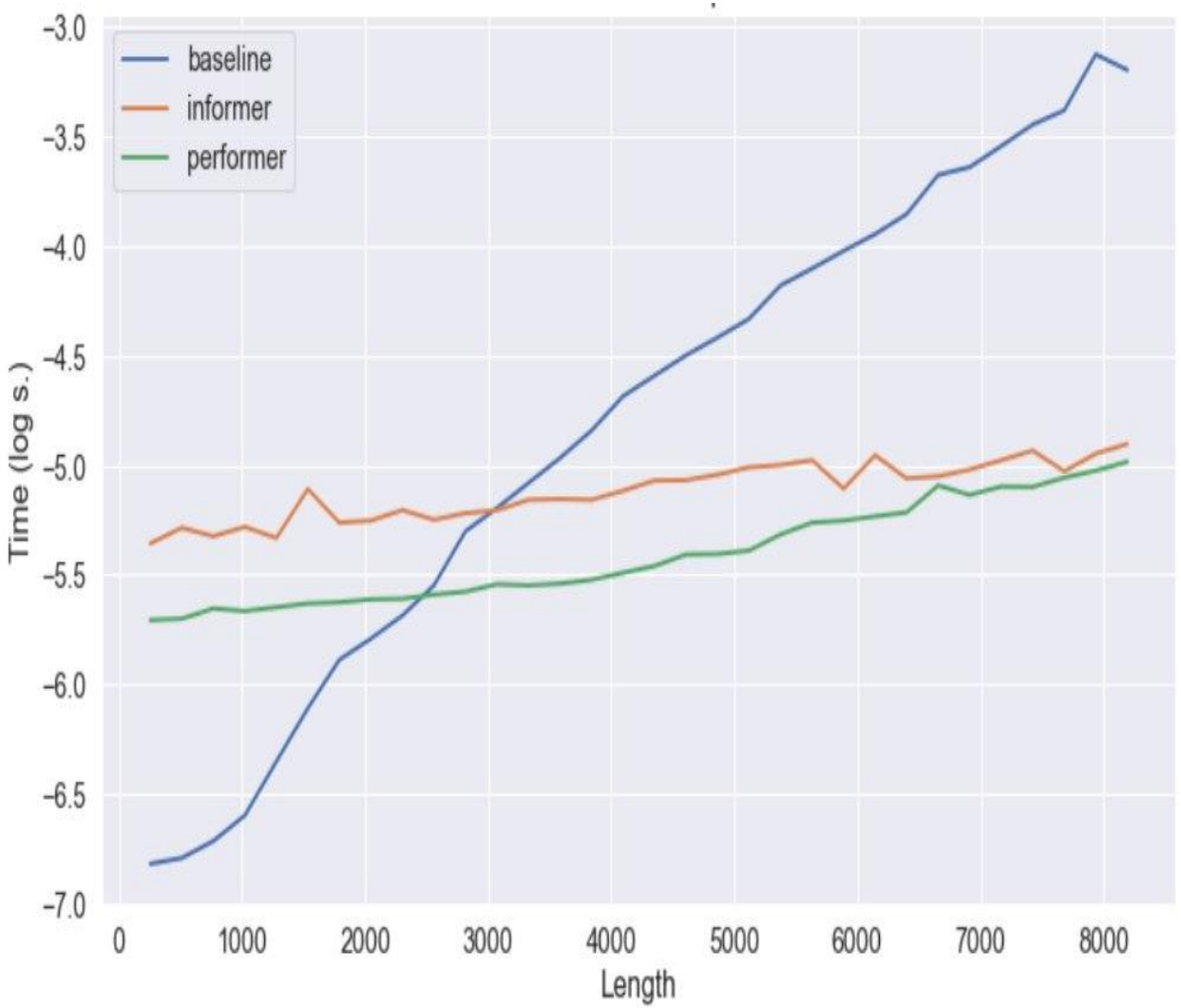


pic.2.Baseline

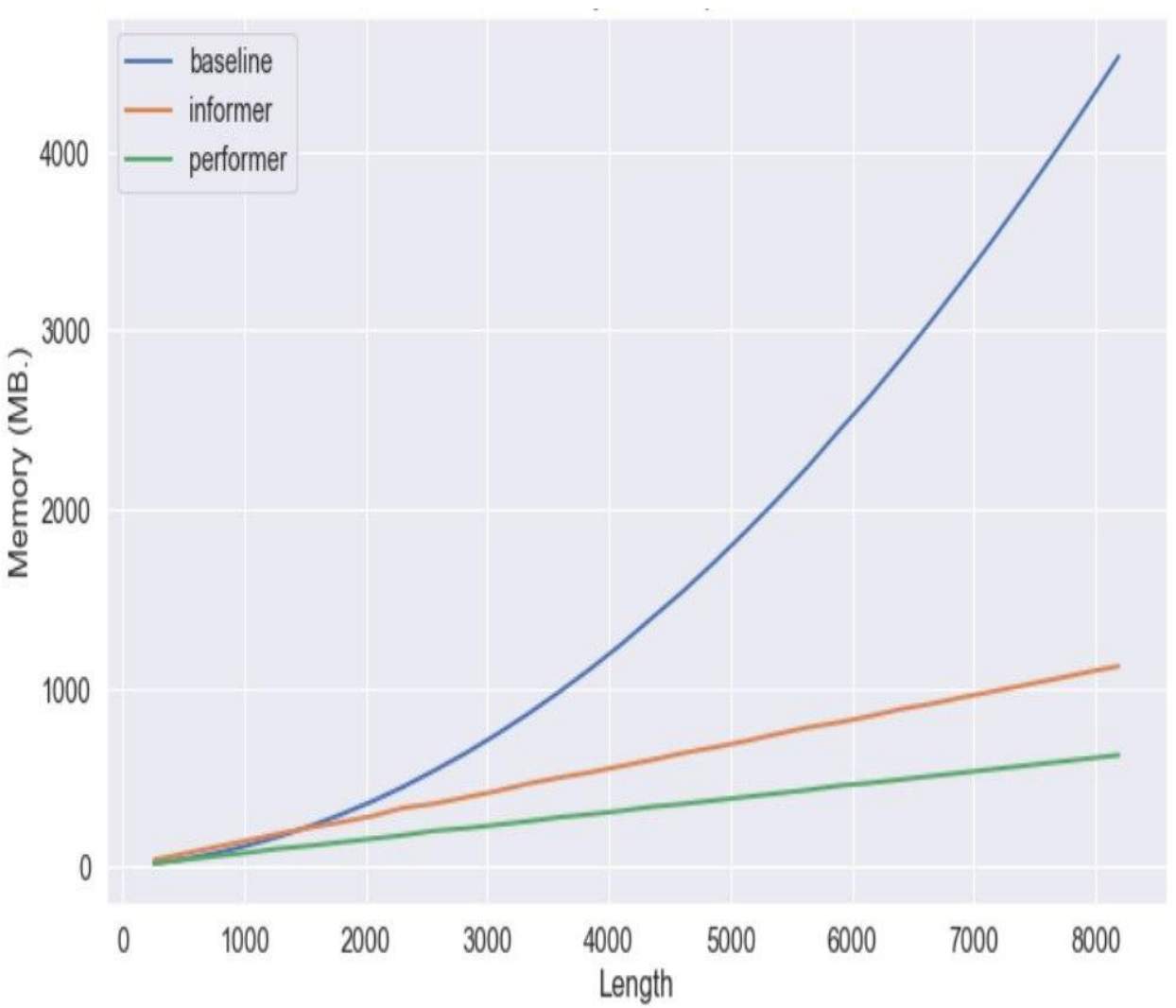


pic.3. Informer

Inference Time Comparison



Memory Consumption



Conclusion

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- **Vanilla transformers** - a sequence transduction model used in encoder-decoder architectures with multi-headed self-attention;
- **Informer** - a transformer extended with an unbounded long-term memory;
- **Performer** - a transformer relied on Fast Attention Via positive Orthogonal Random features mechanism.

Experiments on transaction data to determine a customer's gender

=> the Performer and Informer model <[memory and temporal complexity]< baseline model

Thx

for your attention

remember attention is all you need