Previous Works

- Performer (Choromanski et al.,) uses a finite-dimensional map φ to approximate exponential
    - Vectors with larger norms require φ with larger dimension

- Other works consider arbitrary φ instead of first defining $\text{sim}(\cdot, \cdot)$
    - $\varphi(x) \doteq \text{elu}(x) + 1$ (Katharopoulos et al. '20), $\varphi(x) \doteq \text{relu}(x)$
    - Model quality is worse compared to softmax

- Is softmax necessary? Do any other functions with similar properties work?

- Consider $\text{sim}(q, k) = \langle q, k \rangle^p$ where $p \geq 2$ is an even integer
    - Always ≥ 0
    - Increases as $\langle q, k \rangle$ goes up

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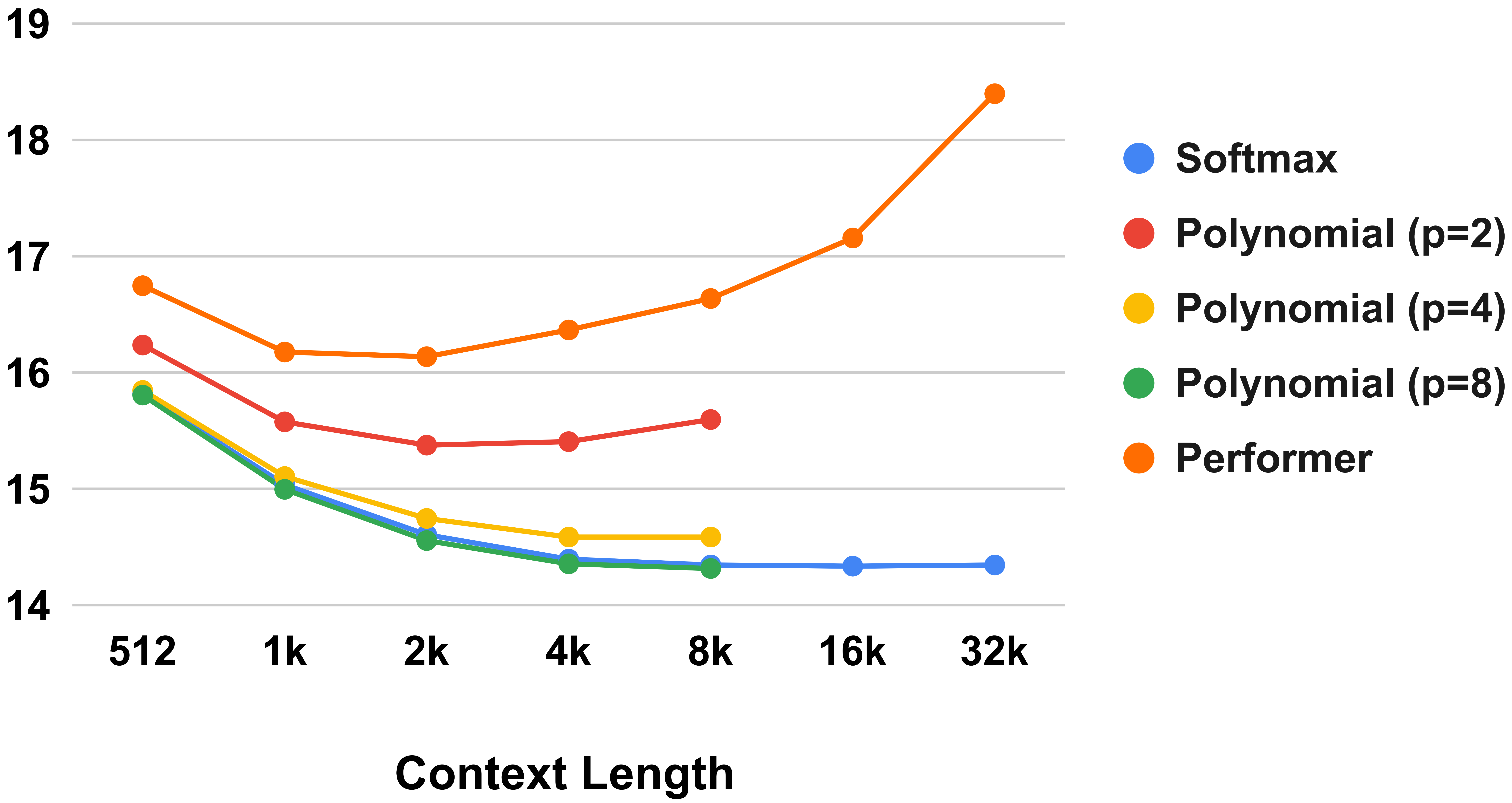
Perplexities on Wiki-40B


1k
2k
4k
8k
16k
32k
Context Length
Softmax
Polynomial (p=2)
Polynomial (p=4)
Polynomial (p=8)
Performer