"A Neural Algorithm for a Fundamental Computing Problem"

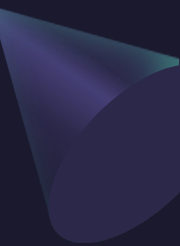Authors: Sanjoy Dasgupta, Charles F. Stevens, Saket Navlakha

Presentation by Andre Ye

Does a fly-inspired similarity search algorithm perform better than traditional ones?

Main Question

What is Similarity Searching?

Similarity searching identifies which tags an item has.
Similar items should have similar tags.
Applications: song recommendation, web searching

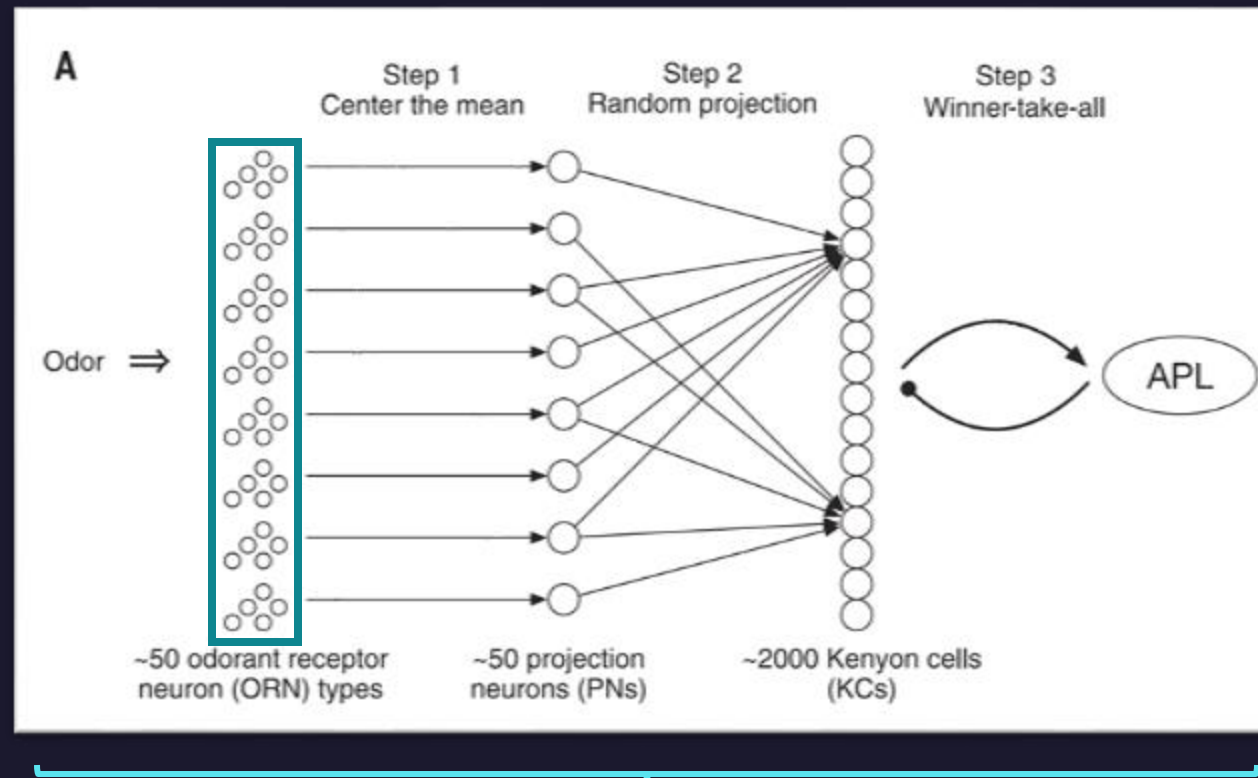**Tags:** White head, brown body, yellow beak, facing left.

Tags: White head, brown body, yellow beak, facing right.

The Fly Olfactory Circuit

Flies compute if odors are similar or different from ones they have smelled before.

Fly olfactory circuit

The Fly Olfactory Circuit
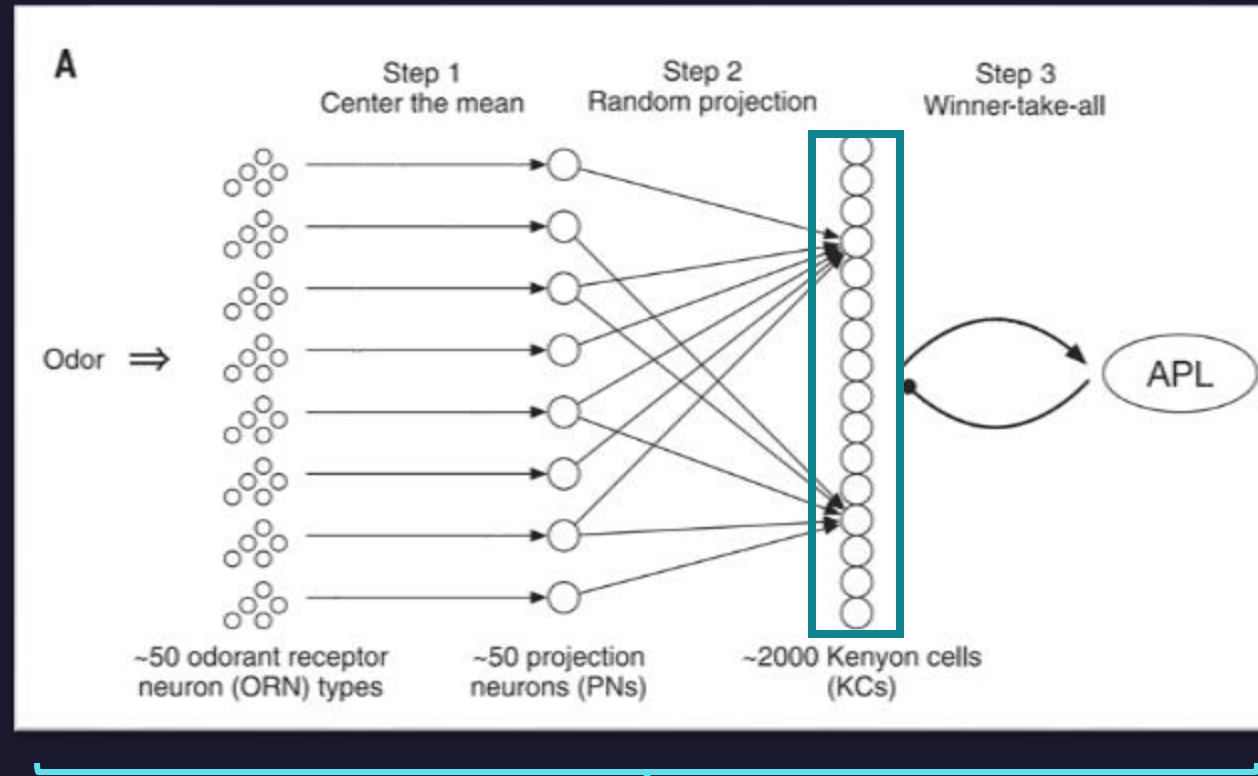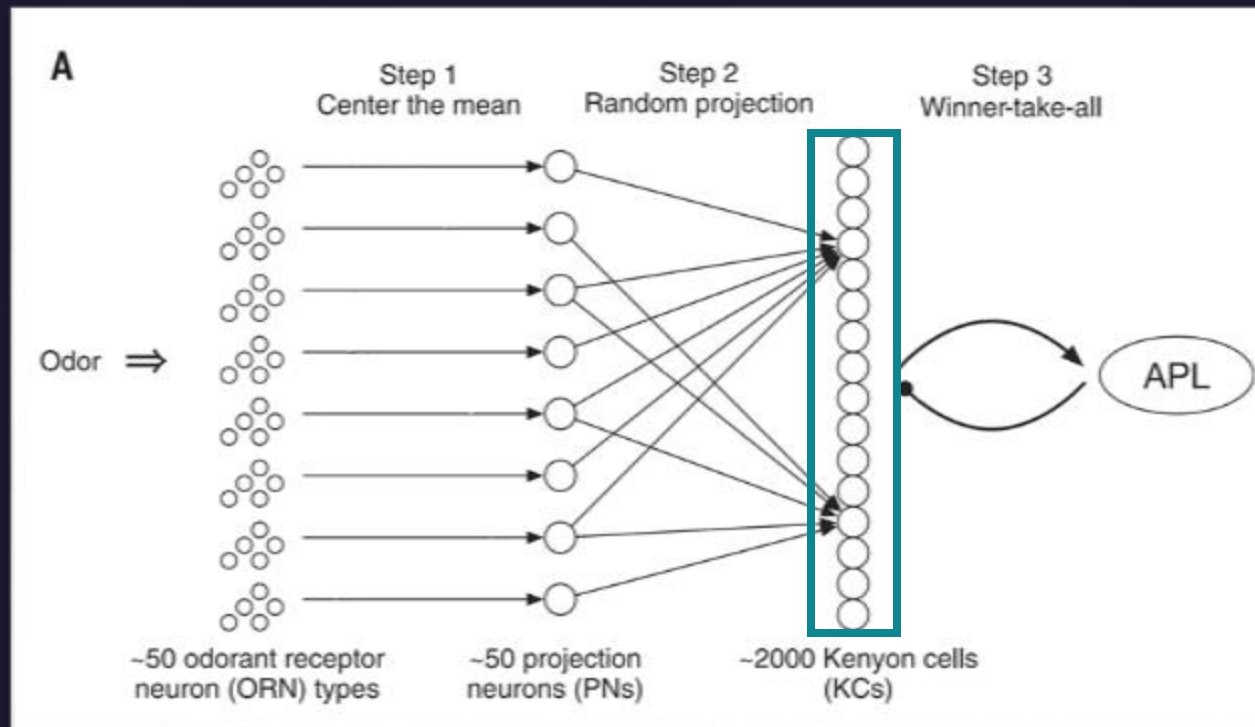
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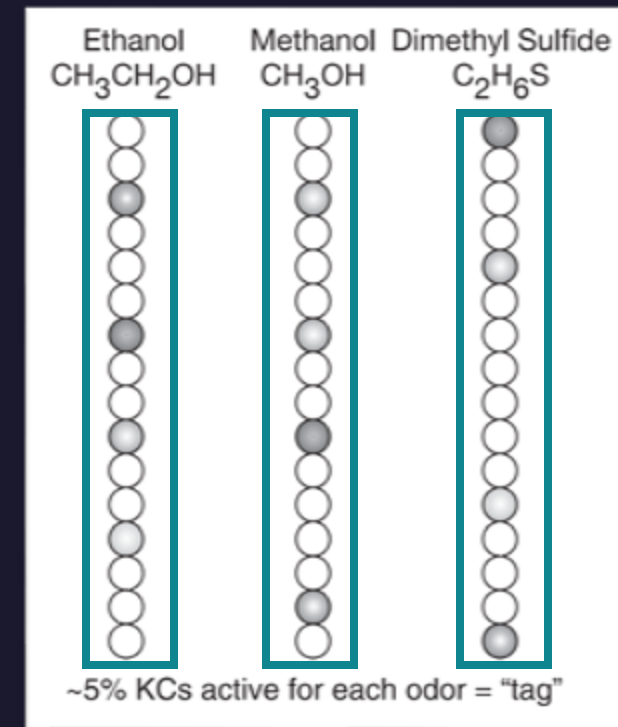

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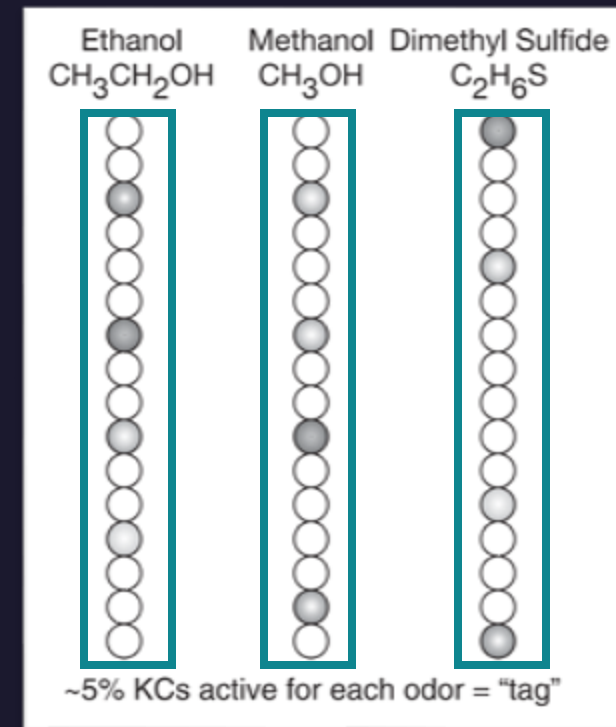

Fly olfactory circuit

'Tags' produced for chemicals

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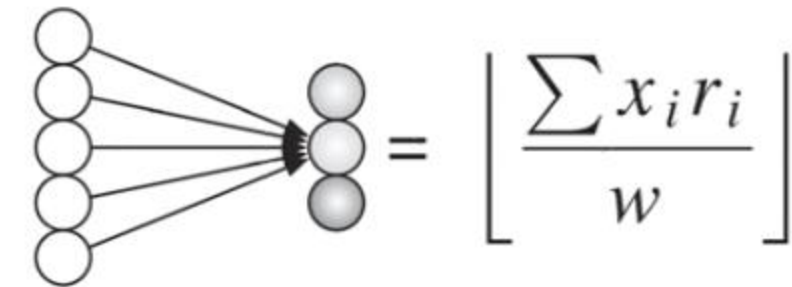
Flies perform similarity searching on odors.
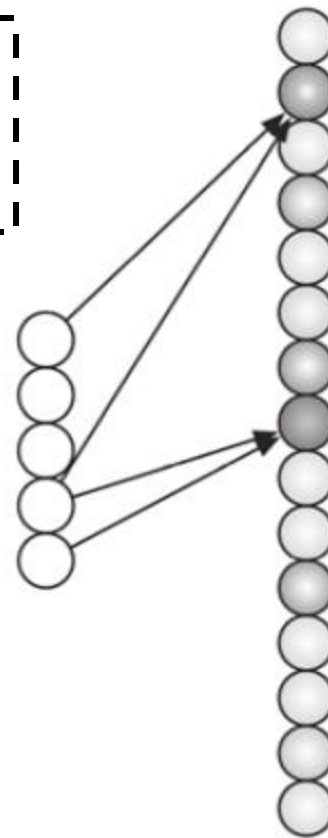

'Tags' produced for chemicals

Building a 'Fly' Similarity Search Algorithm

Main Difference: traditional methods are denser, fly algorithm is sparser.
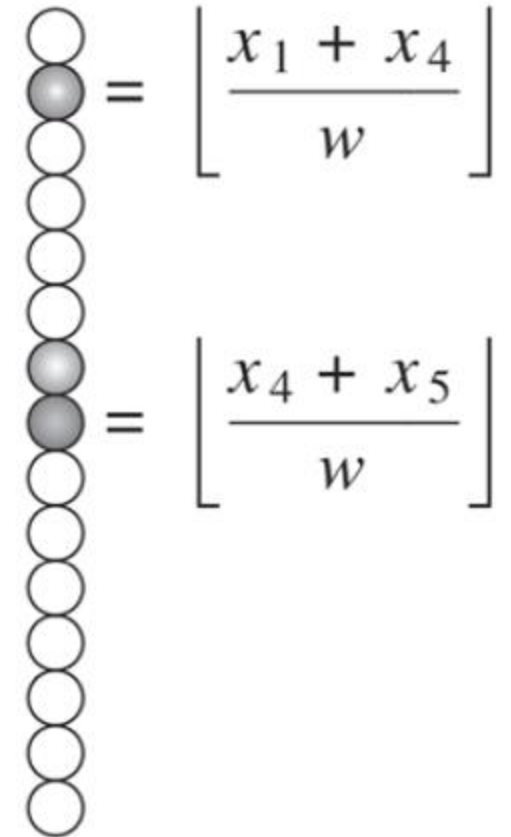*Which one will perform better?*
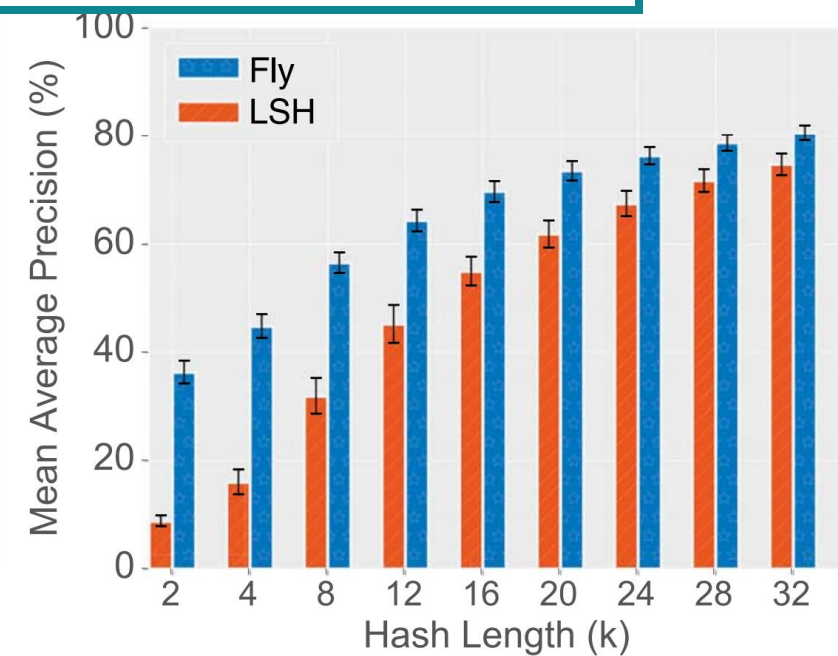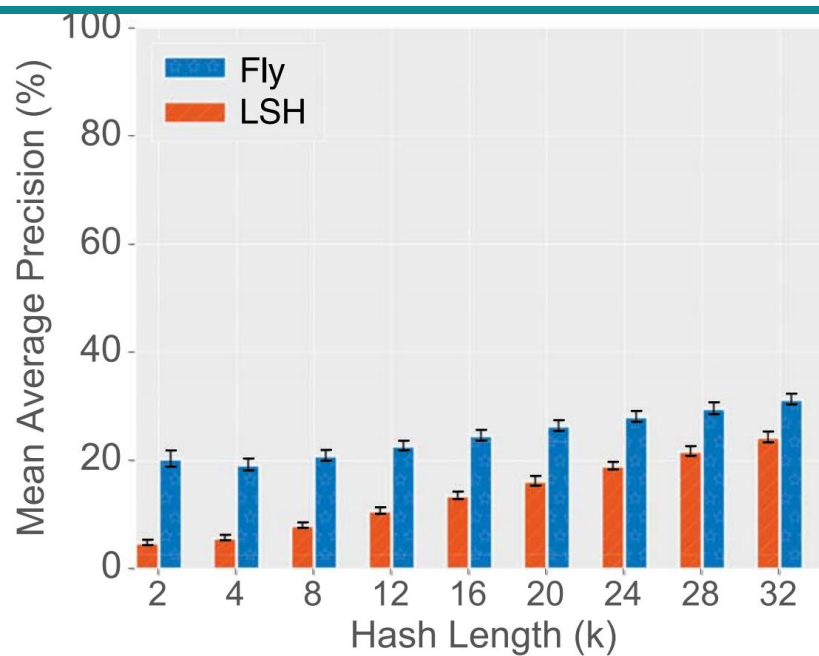
Input

LSH (Traditional Similarity Search Algorithm)

$$= \left\lfloor \frac{\sum x_i r_i}{w} \right\rfloor$$

$$\Rightarrow$$

$$= \left\lfloor \frac{x_1 + x_4}{w} \right\rfloor$$

$$= \left\lfloor \frac{x_4 + x_5}{w} \right\rfloor$$

Fly (Similarity search algorithm inspired by fly olfactory system)

Evaluating the Algorithm

Fly algorithm performed better than traditional, especially comparatively for lower values of *k*.

k = 'complexity' of the model.

Scales well to larger datasets, which require lower values of *k*.

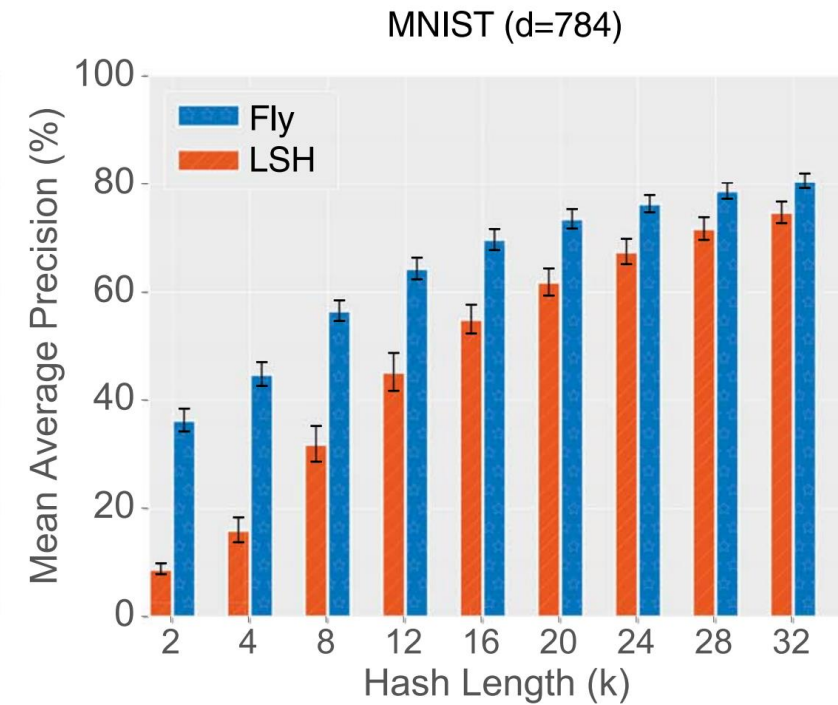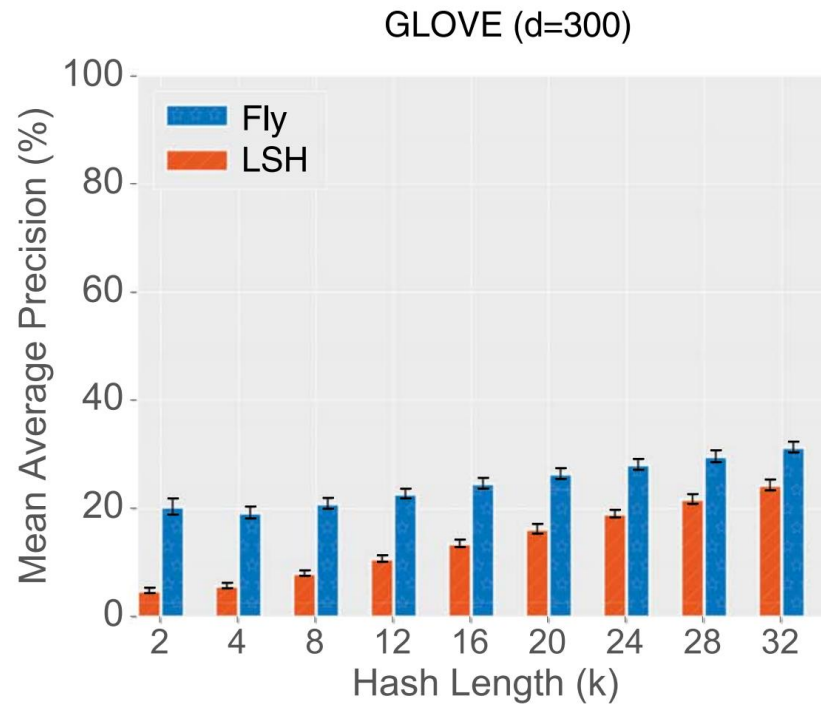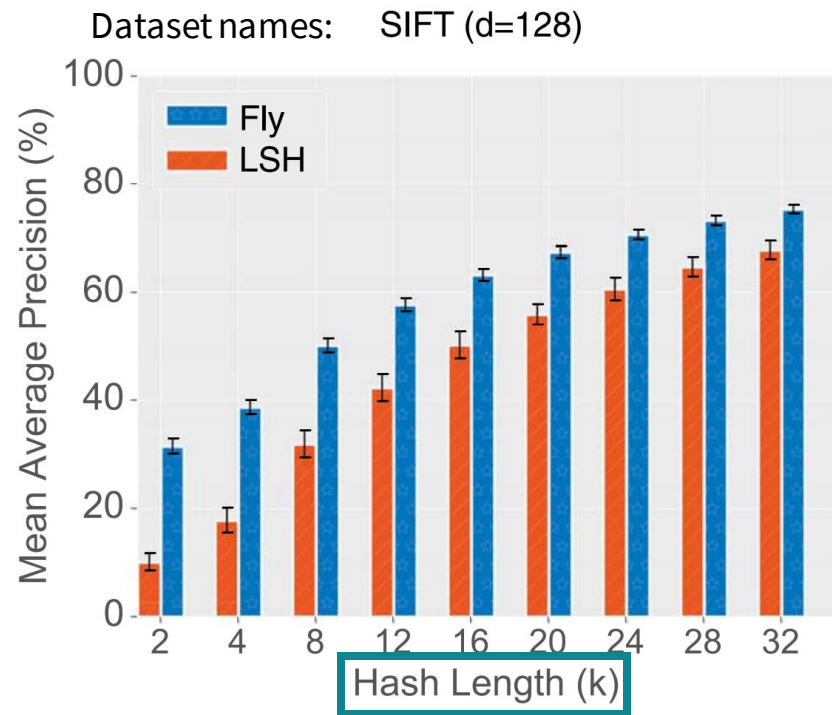Dataset names: SIFT (d=128), GLOVE (d=300), MNIST (d=784)
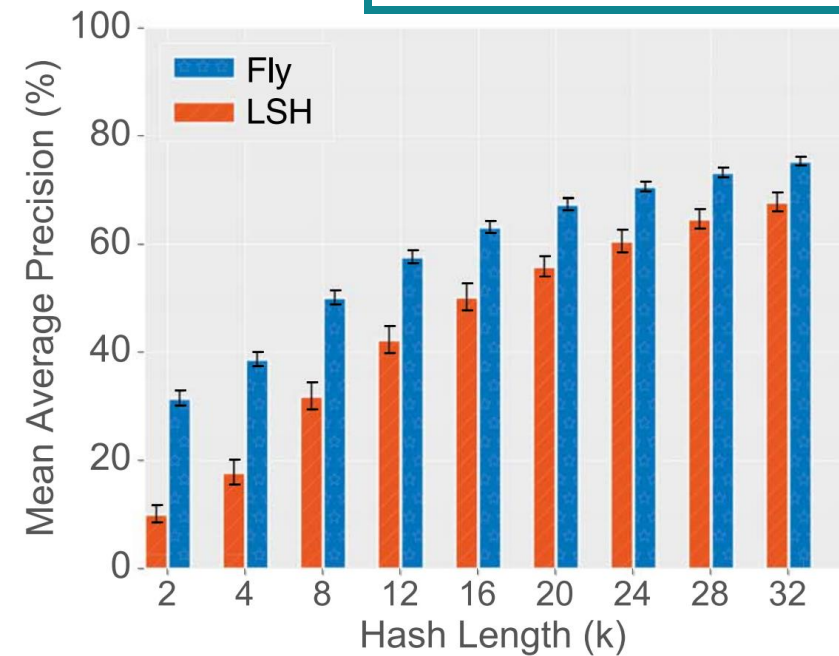
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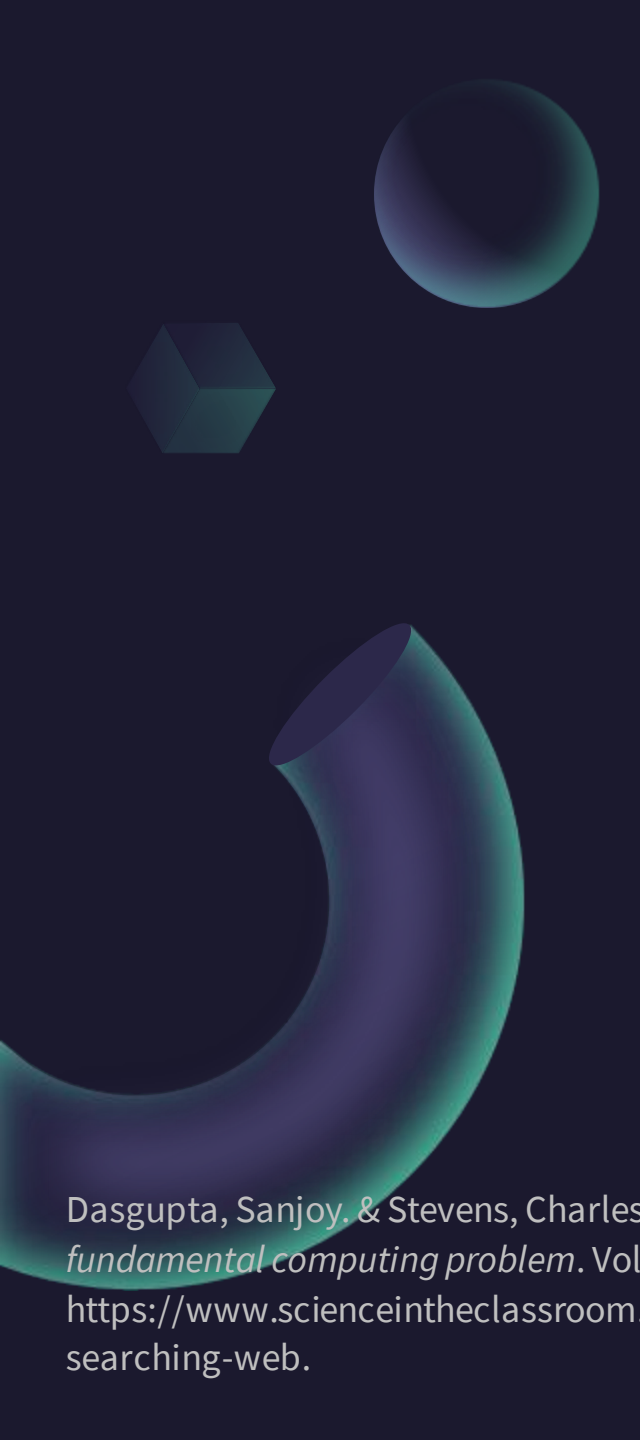Scales well to larger datasets, which require lower values of *k*.

Computer scientists were able to find a **better algorithm** by drawing **inspiration** from the biology of a fly.

"digital biomimicry"

Dasgupta, Sanjoy. & Stevens, Charles. F. & Navlakha, Saket. (2017). *A neural algorithm for a fundamental computing problem*. Vol. 358, Issue 6364, pp. 793-796. Retrieved from https://www.scienceintheclassroom.org/research-papers/what-flies-can-teach-us-about-searching-web.