TEXAS
The University of Texas at Austin

Entity-Focused Dense Passage Retrieval for Outside-Knowledge Visual Question Answering

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Knowledge Retrieval for OK-VQA

Q: This plush toy was named after what US president?

The name **teddy bear** comes from former United States President **Theodore Roosevelt**, who was often referred to as "Teddy"

EnFoRe Approach

Step1: Entities Set Construction

Q: This plush toy was named after what US president? A: Teddy Roosevelt

Question-based Entities:
Phrases in question: plush toy, president,
Answer candidates: Roosevelt, …
Sub-questions: Teddy bear, …

Image-based Entities:
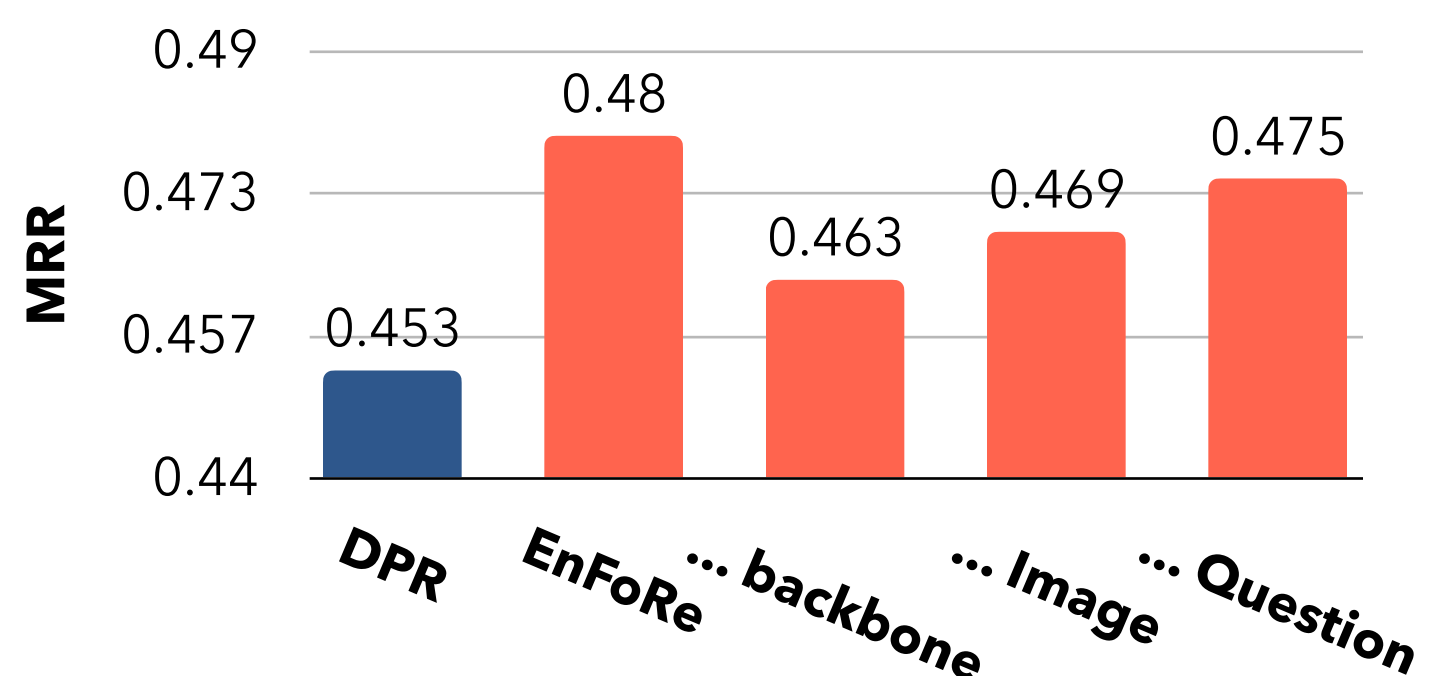Azure Tagging: Teddy bear, …
Clip Tagging: Teddy bear, …
Phrases in captions: Infant, …

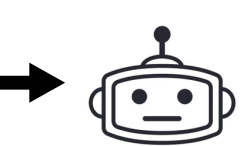### Step2: Oracle entities detection
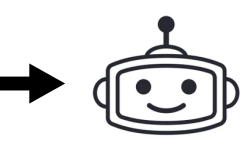
Is the large yellow object a fruit or a vegetable?

Sparse Passage Retriever

A banana is an elongated, edible fruit - botanically a berry - produced by several kinds of large herbaceous

1/3 =0.33

Is the large yellow object a fruit or a vegetable?
Bell Pepper

Bell pepper The **bell pepper** is … in different colors, including red, yellow, orange, …they are commonly used as a vegetable ingredient

1/1+1/4 =1.25

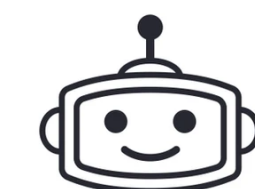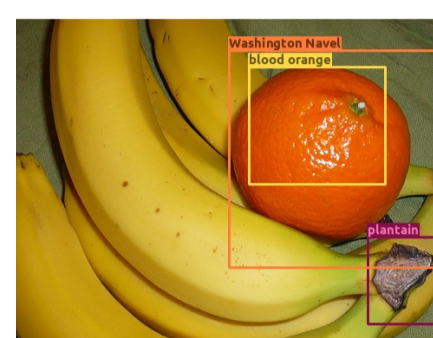**Measured by summed reciprocal ranking**

Step3: Entity-Focused Dense Retrieval

Q: This plush toy was named after what US president?

query features f_q

Entity set construction (Sec 3)

Query

query-entity importance S_{qe}

entity features f_e

plush toy
president
teddy bear (oracle)
infant

Entities

Entity matching + Query-passage matching

Passage 1
…
A teddy bear is a stuffed toy in the form of a bear …, and named after President Theodore Roosevelt …, the teddy bear …

Passages

passage-entity importance S_{pe}

passage features f_p

Why Entity-Focused Retrieval

Q: What holiday is this?
A: Thanksgiving.
Critical entity: **turkey**

Q: Is the large yellow object a fruit or a vegetable? **A:** vegetable.
critical entity: **bell pepper**

Fitting in the VQA context

Knowledge Retrieval Results on OKVQA

MRR

DPR 0.453
EnFoRe 0.48
… backbone 0.463
… Image 0.469
… Question 0.475

Human Evaluation
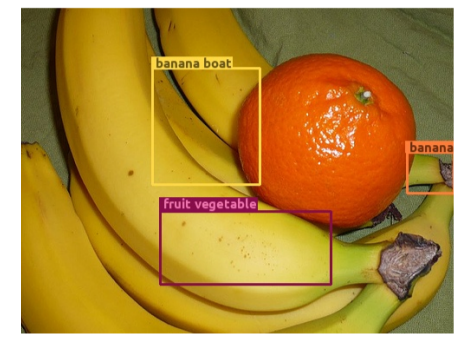Judging whether KAT knowledge or EnFoRe knowledge contains the most supportive evidence to the answer?

Q: What is the main benefits of healthy properties these fruit contain? A: potassium

EnFoRe

KAT

EnFoRe wins 61.8%

Naturally, the fruit of the Hassaku orange is a good source of vitamin C, folic acid, potassium and fiber.

Fruit vegetable is a fruit commonly referred to as a vegetable because they are savory (not sweet).

VQA Results on OKVQA

VQA Score

KAT-base 0.506
… + EnFoRe 0.522
KAT-full 0.544
… + EnFoRe 0.552