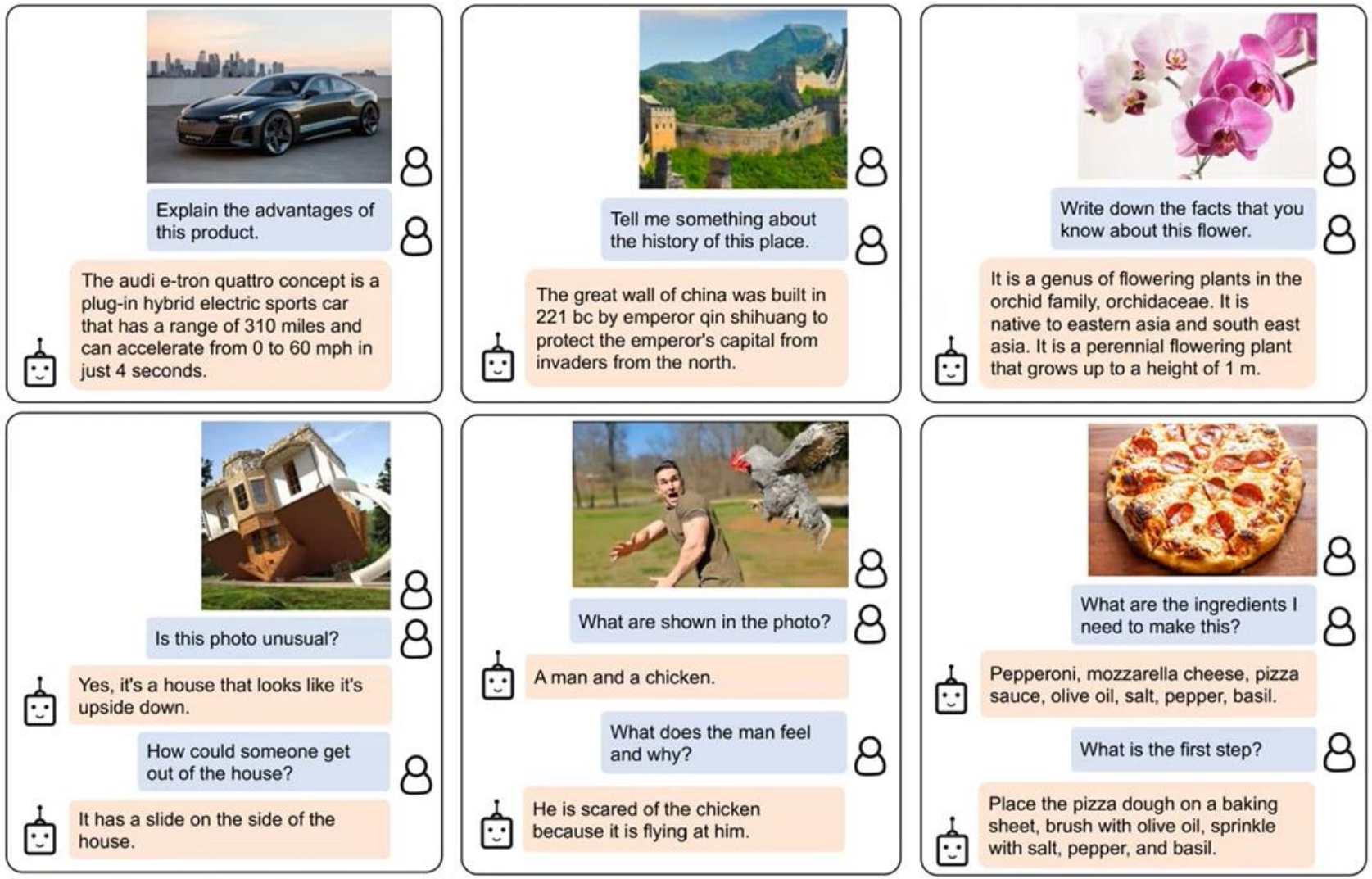
What can the BLIP-2 model do?

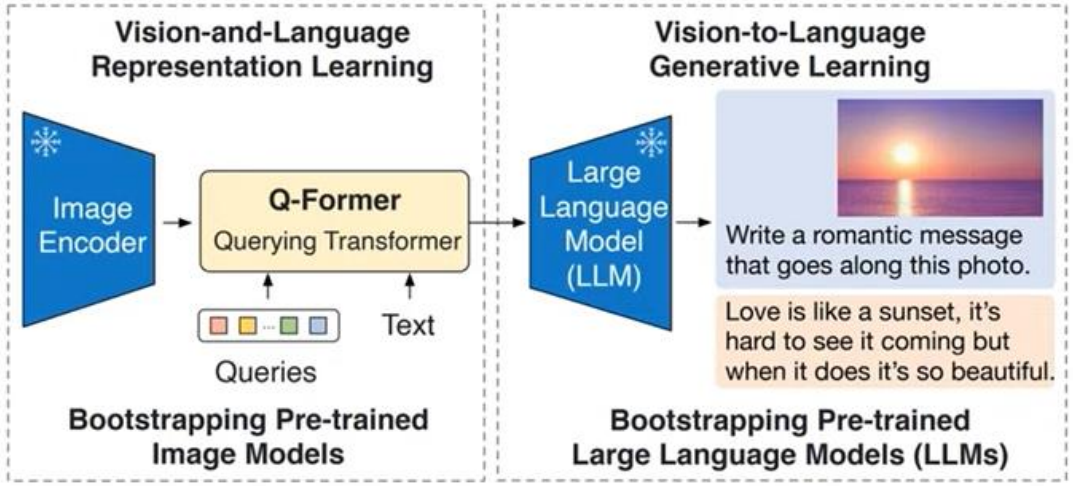


- Instructed zero-shot image-to-text generation
  - Visual conversation
  - Visual knowledge reasoning
  - Visual commensense reasoning
  - Storytelling
  - Personalized image-to-text generation

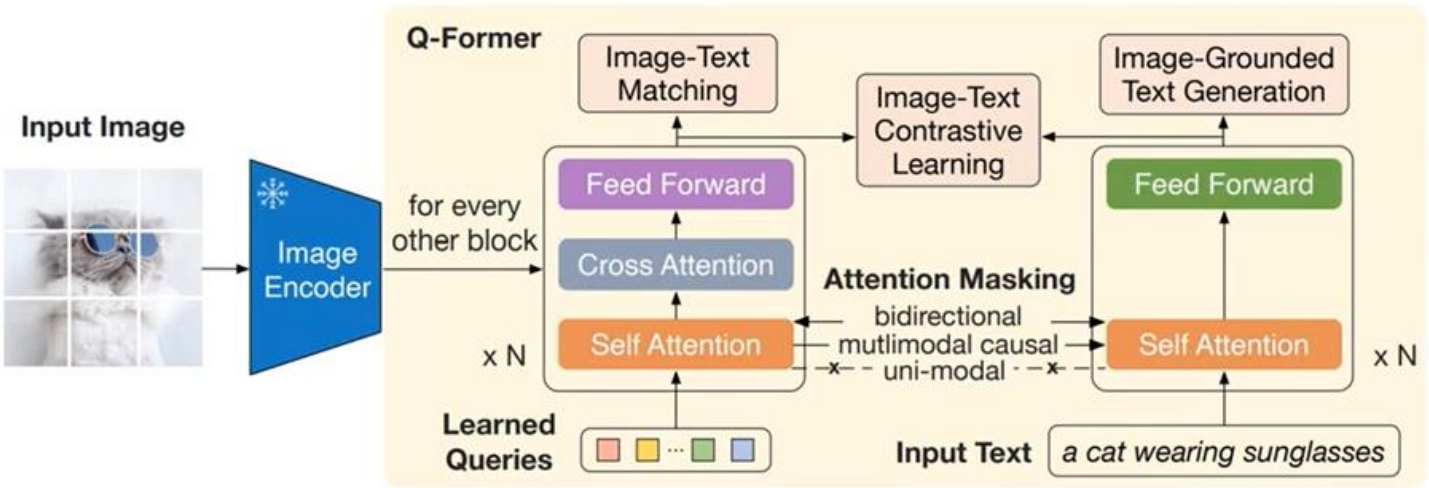
Li, Junnan, Dongxu Li, Silvio Savarese, and Steven Hoi. "Blip-2: Bootstrapping language-image pre-training with frozen image encoders and large language models." arXiv:2301.12597 (2023).

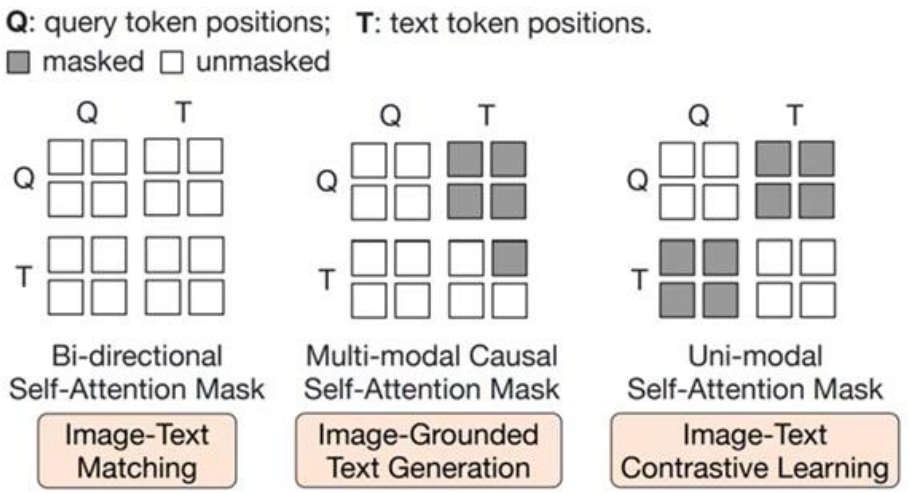
Data Science Gems (Director). (2023, November 18). BLIP2: BLIP with frozen image encoders and LLMs [Video recording]. https://www.youtube.com/watch?v=wcxXmo6i3p4

How is the BLIP-2 model pretrained?



- Querying Transformer (Q-Former) pre-trained in two stages:
  - Vision-language representation learning stage with a frozen image encoder
  - Vision-to-language generative learning stage with a frozen LLM.
- Q-Former=image transformer+ text transformer
- Queries interact with
  - each other and optionally text through self-attention layers
  - frozen image features through cross-attention layers





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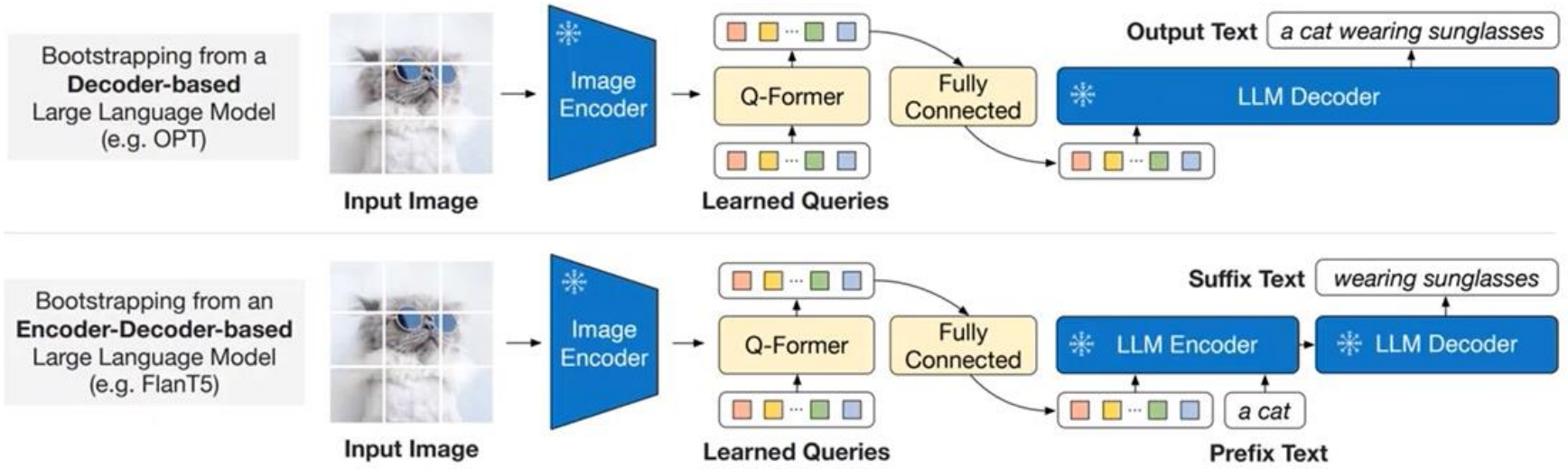

- Pre-training dataset
  - Same as BLIP
  - 129M images from COCO, Visual Genome, CC3M, CC12M, SBU
  - 115M images from LAION400M dataset
  - CapFilt method to create synthetic captions for the web images.
- Pre-trained image encoder
  - ViT-L/14 from CLIP
  - ViT-g/14 from EVA-CLIP
- Frozen language model
  - OPT for decoder-based LLMs
  - FlanT5 for encoder-decoder-based LLMs.

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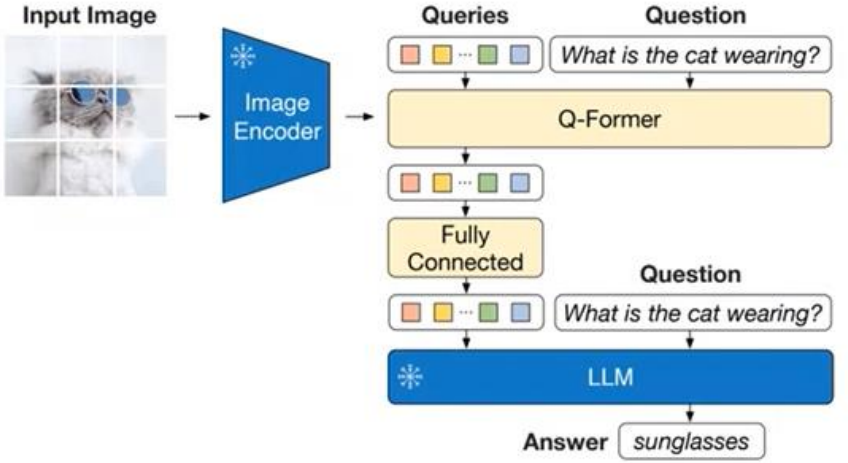
How does BLIP-2 model perform?

Models	#Trainable Params	Open-sourced?	Visual Question Answering VQAv2 (test-dev) VQA acc.	Image Captioning NoCaps (val) CIDEr	SPICE	Image-Text Retrieval Flickr (test) TR@1	IR@1
BLIP (Li et al., 2022)	583M	✓	-	113.2	14.8	96.7	86.7
SimVLM (Wang et al., 2021b)	1.4B	✗	-	112.2	-	-	-
BEIT-3 (Wang et al., 2022b)	1.9B	✗	-	-	-	94.9	81.5
Flamingo (Alayrac et al., 2022)	10.2B	✗	56.3	-	-	-	-
BLIP-2	188M	✓	**65.0**	**121.6**	**15.8**	**97.6**	**89.7**



Zero-shot vision-language tasks

- OPT prompt "Question: {} Answer:" FlanT5 prompt "Question: {} Short answer:"
- BLIP-2 > Flamingo80B by 8.7% on VQAv2, despite having 54x fewer trainable parameters.

Models	#Trainable Params	NoCaps Zero-shot (validation set) in-domain C	in-domain S	near-domain C	near-domain S	out-domain C	out-domain S	overall C	overall S	COCO Fine-tuned Karpathy test B@4	C
OSCAR (Li et al., 2020)	345M	-	-	-	-	-	-	80.9	11.3	37.4	127.8
VinVL (Zhang et al., 2021)	345M	103.1	14.2	96.1	13.8	88.3	12.1	95.5	13.5	38.2	129.3
BLIP (Li et al., 2022)	446M	114.9	15.2	112.1	14.9	115.3	14.4	113.2	14.8	40.4	136.7
OFA (Wang et al., 2022a)	930M	-	-	-	-	-	-	-	-	**43.9**	145.3
Flamingo (Alayrac et al., 2022)	10.6B	-	-	-	-	-	-	-	-	-	138.1
SimVLM (Wang et al., 2021b)	~1.4B	113.7	-	110.9	-	115.2	-	112.2	-	40.6	143.3
BLIP-2 ViT-g $OPT_{2.7B}$	1.1B	123.0	15.8	117.8	15.4	123.4	**15.1**	119.7	15.4	43.7	**145.8**
BLIP-2 ViT-g $OPT_{6.7B}$	1.1B	**123.7**	15.8	119.2	15.3	124.4	14.8	121.0	15.3	43.5	145.2
BLIP-2 ViT-g $FlanT5_{XL}$	1.1B	**123.7**	**16.3**	**120.2**	**15.9**	**124.8**	**15.1**	**121.6**	**15.8**	42.4	144.5

Models	#Trainable Params	VQAv2 test-dev	VQAv2 test-std
Open-ended generation models			
ALBEF (Li et al., 2021)	314M	75.84	76.04
BLIP (Li et al., 2022)	385M	78.25	78.32
OFA (Wang et al., 2022a)	930M	82.00	82.00
Flamingo80B (Alayrac et al., 2022)	10.6B	82.00	82.10
BLIP-2 ViT-g $FlanT5_{XL}$	1.2B	81.55	81.66
BLIP-2 ViT-g $OPT_{2.7B}$	1.2B	81.59	81.74
BLIP-2 ViT-g $OPT_{6.7B}$	1.2B	**82.19**	**82.30**

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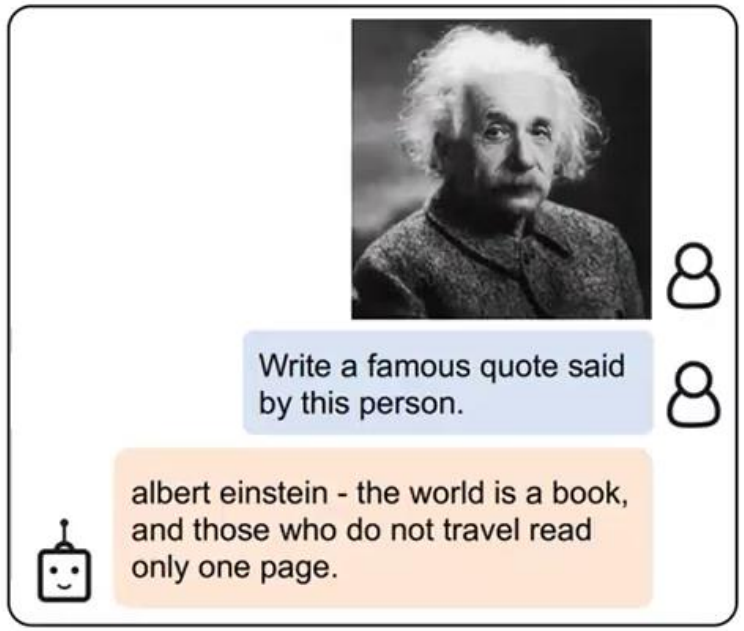
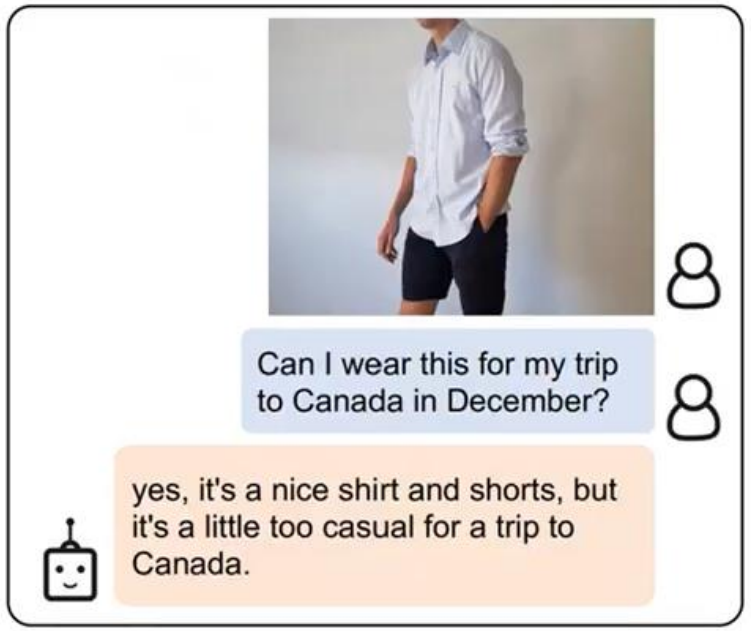
How does BLIP-2 model perform?



Inaccurate knowledge
(quote is from a different person)



Incorrect reasoning path
(should have considered weather)

Information not up-to-date
(this is iphone 14)

- Inaccurate knowledge from the LLM
- Activating the incorrect reasoning path
- Not having up-to-date information about new image content.

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Summary

- BLIP-2: a generic and compute-efficient method for vision-language pre-training that leverages frozen pretrained image encoders and LLMs.
- SOTA on various vision-language tasks while having a small amount of trainable parameters during pre-training.
- Emerging capabilities in zero-shot instructed image-to-text generation.
- https://github.com/salesforce/LAVIS/tree/main/projects/blip2

- Thanks for watching!
- LinkedIn: http://aka.ms/manishgupta
- HomePage: https://sites.google.com/view/manishg/

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