The power of VLMs

Advanced LLM Night

Eivind Kjosbakken – Findable

January 2025

Me

Master's in Engineering and ICT from NTNU

- Main focus on AI
- One year exchange at TU Delft

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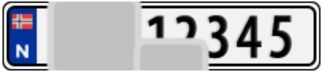
Master's in Engineering and ICT from NTNU

- Main focus on AI
- One year exchange at TU Delft

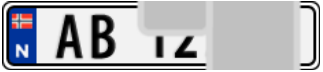
Have been a part of Findable since 2021

- Part-time AI-trainer
- Wrote my master's thesis within ML at Findable
- Full-time data scientist

License Plate Recognition

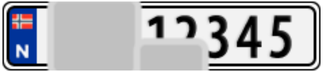


+

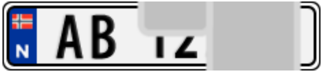


Provide the full license plate number

License Plate Recognition



+



Provide the full license plate number

↓

The full license plate number is AB12345.

Performed with Qwen2-VL-7B-Instruct

Overview

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How vision is integrated in VLMs

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VLM usecases

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- Information extraction

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VLM Drawbacks

Overview

How vision is integrated in VLMs

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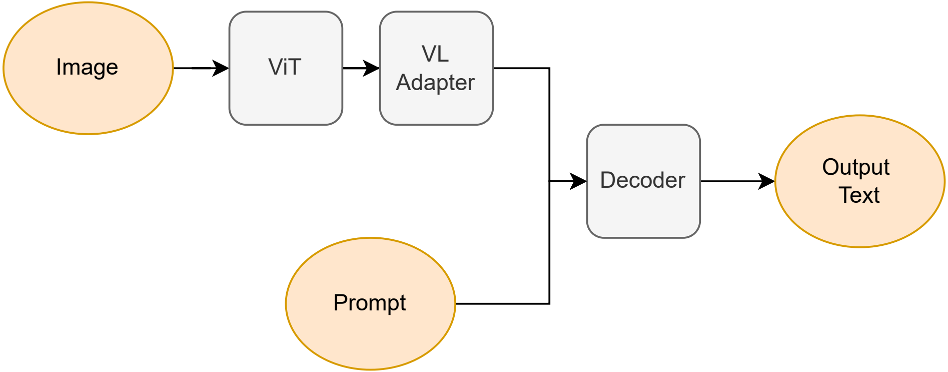
VLM Drawbacks

Staying up to date with VLM advances

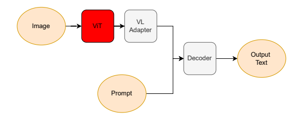
Intro to VLMs

How do they work



How vision integrates in VLMs - ViT

VLM overview



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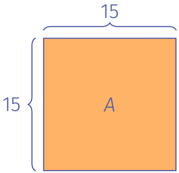
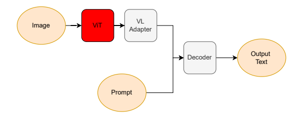


VLM overview



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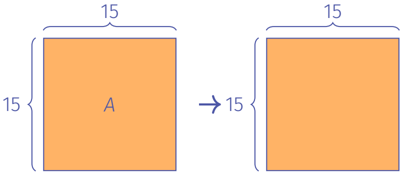

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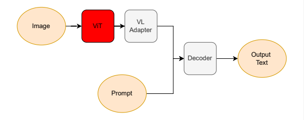

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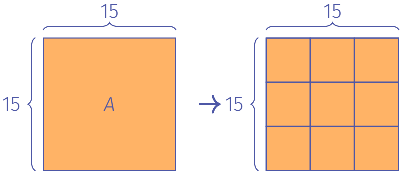

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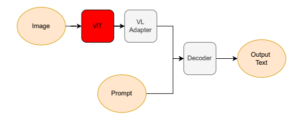

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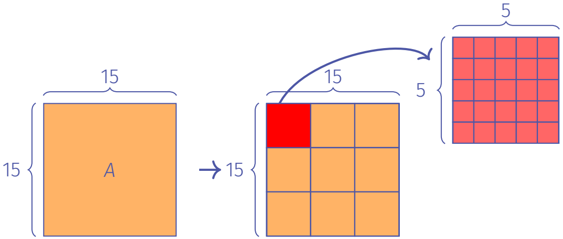

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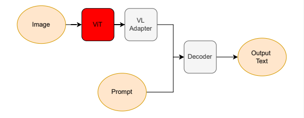

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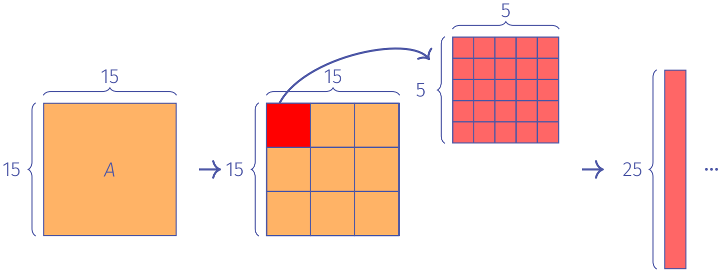

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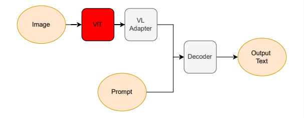

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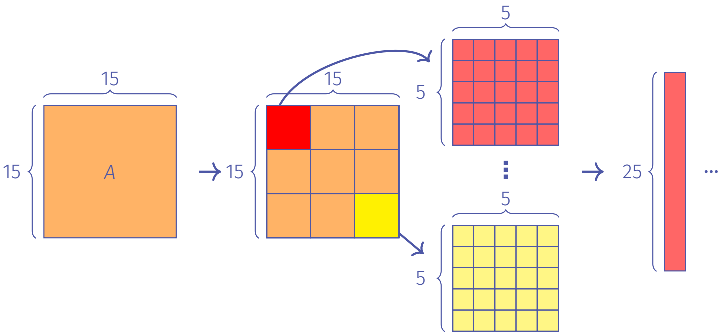

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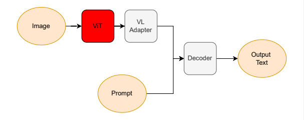

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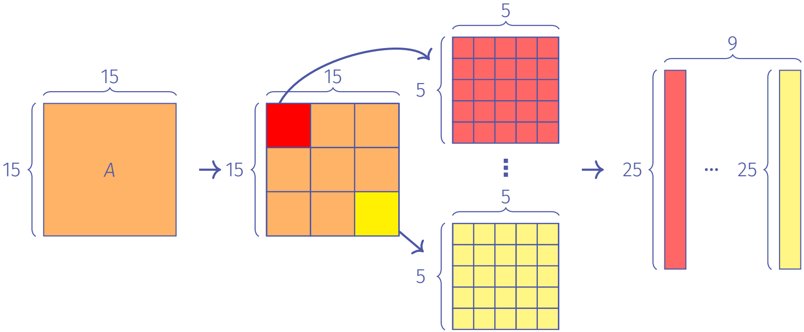

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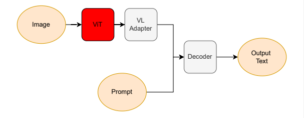

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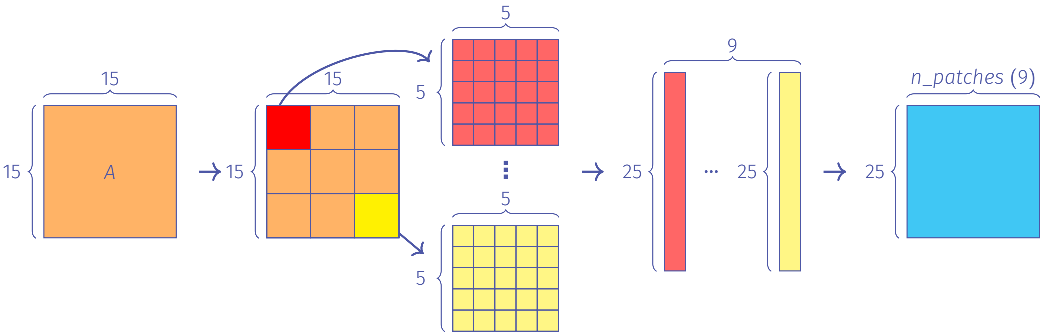

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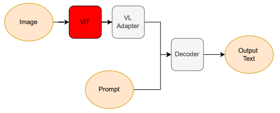
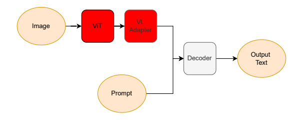


How vision integrates into the LLM - Transformer layers

VLM overview



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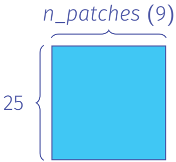

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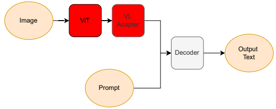

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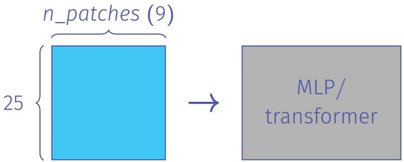

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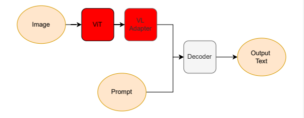

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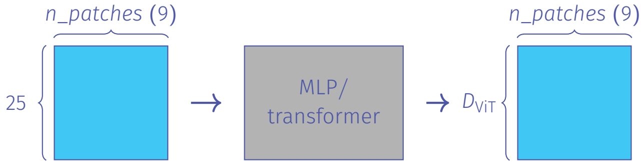


$n\_patches$ (9)

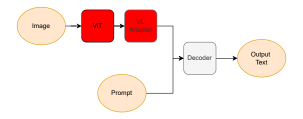
25

MLP/ transformer

$n\_patches$ (9)

D_{ViT}

VLM overview



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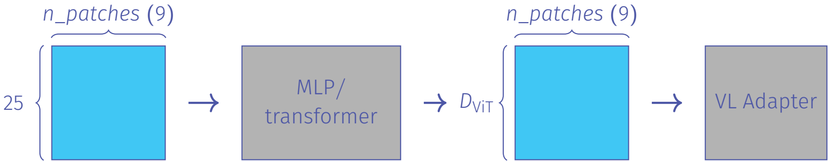
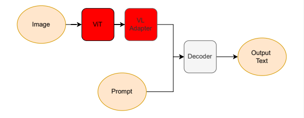


$\overbrace{\quad}^{n\_patches\ (9)}$ 25 → MLP/ transformer → D_{ViT} $\overbrace{\quad}^{n\_patches\ (9)}$ → VL Adapter

VLM overview



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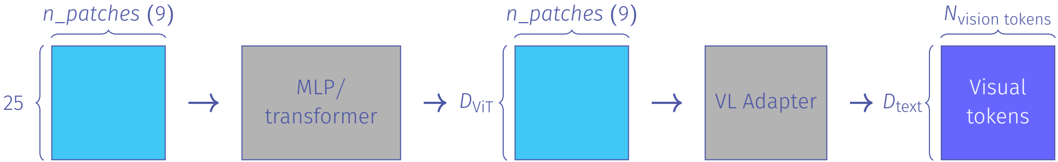


$n\_patches$ (9)

25

MLP/ transformer

D_{ViT}

$n\_patches$ (9)

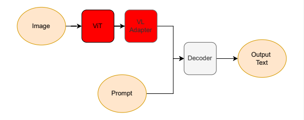
VL Adapter

D_{text}

$N_{\text{vision tokens}}$

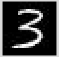
Visual tokens

VLM overview



Decoder input sequence

Prompt

Describe this image 

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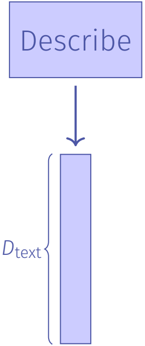


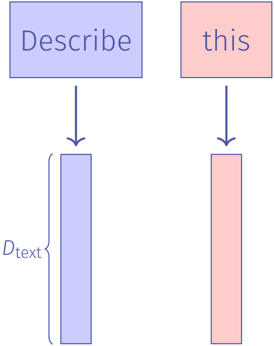
Describe

D_{text}

Decoder input sequence

Prompt

Describe this image



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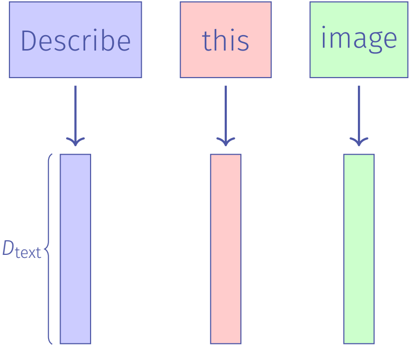


Describe

this

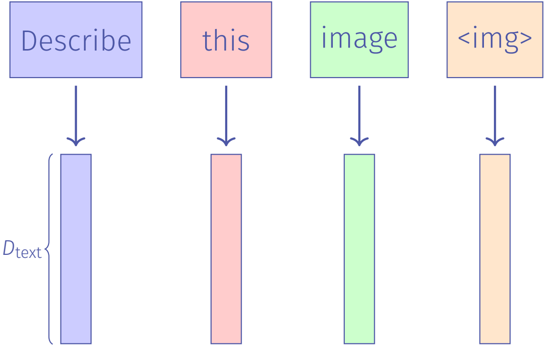
image

D_{text}

DECODER INPUT SEQUENCE

Prompt

Describe this image

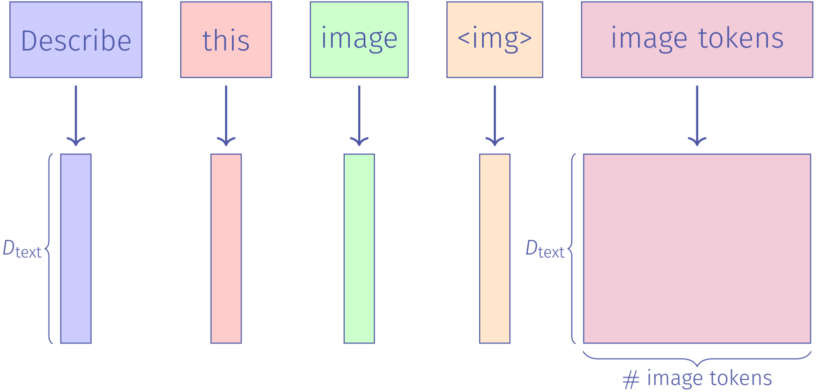

Describe this image <img>

D_{text}

Decoder input sequence

Prompt

Describe this image



Decoder input sequence

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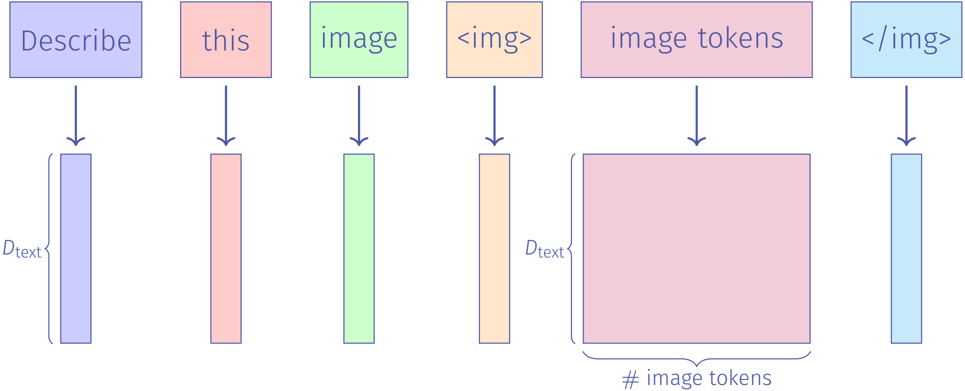


Describe

this

image

<img>

image tokens

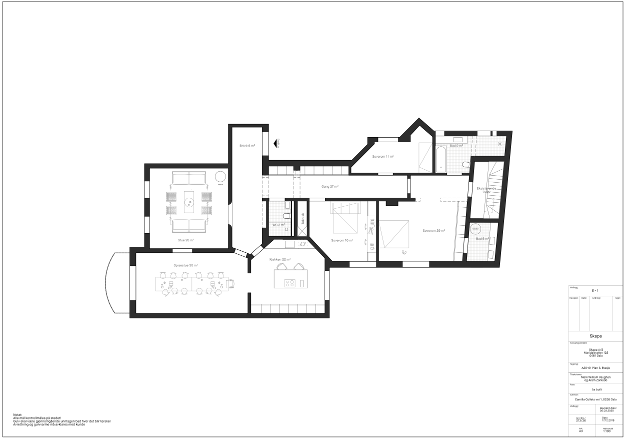
</img>

D_{text}

D_{text}

# image tokens

ARK DRAWING EXAMPLE



Notat:
Alle mål kontrollmåles på stedet!
Gulv skal være gjennomgående unntagen bad hvor det blir terskel
Avrettning og gulvvarme må avklares med kunde

Vedlegg: E - 1			
Revisjon:	Dato:	Endring:	Sign:
Skapa			
Ansvarlig arkitekt: Skapa A/S Maridalsveien 122 0461 Oslo			
Tegning: A20-01 Plan 3. Etasje			
Tiltakshaver: Mark William Vaughan og Aram Zarkoob			
Fase: As built			
Adresse: Camilla Colletts vei 1, 0258 Oslo			
Vedlegg:	Revidert dato: 05.03.2020		
Gnr./Bnr./ 213/36	Dato 17.12.2018		
Ark: A3	Målestokk 1:100		

Not a real customer document. Used with permission City of Oslo Planning and Building Services

VLM INFORMATION EXTRACTION

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Input

- Single or multiple images (no text necessary)
- Prompt

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Output is a series of filled out fields

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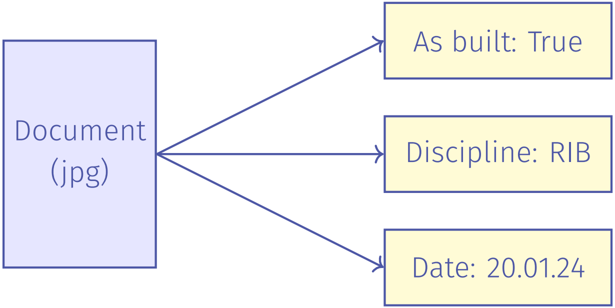

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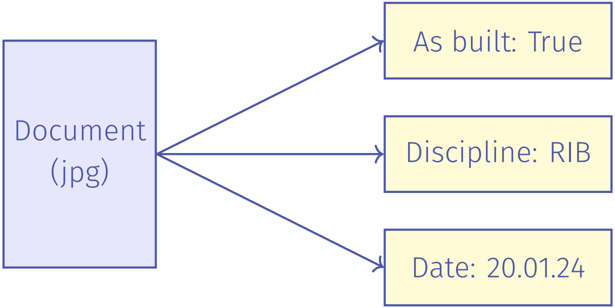
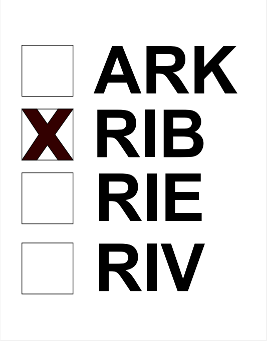


Textual task requiring visual info


☐ ARK
☒ RIB
☐ RIE
☐ RIV

VLM INFORMATION EXTRACTION

Example Information Extraction prompt

```
prompt = ”””
Given the document,
fill out the following JSON object.
Enter None if the field is not available
{
    ”As_built” : ””,
    ”Discipline” : ””,
    ”Drawing_Date”: ””
}
”””
```

VLM CLASSIFICATION

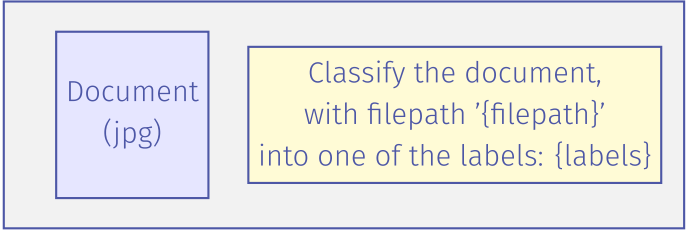
VLM CLASSIFICATION

SFT

VLM CLASSIFICATION

SFT

Input

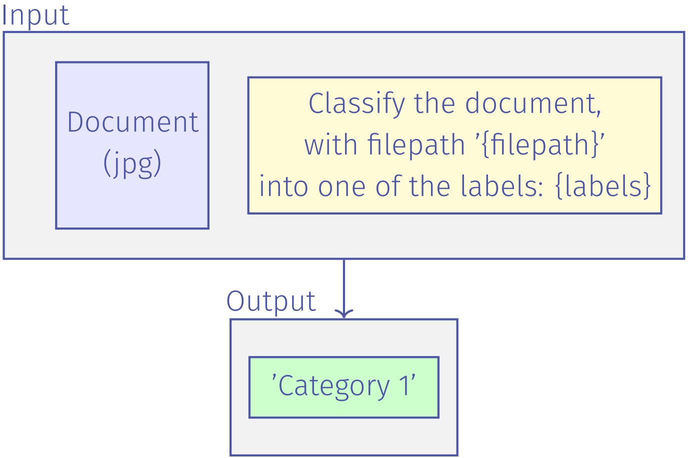


Document (jpg)

Classify the document, with filepath '{filepath}' into one of the labels: {labels}

VLM CLASSIFICATION

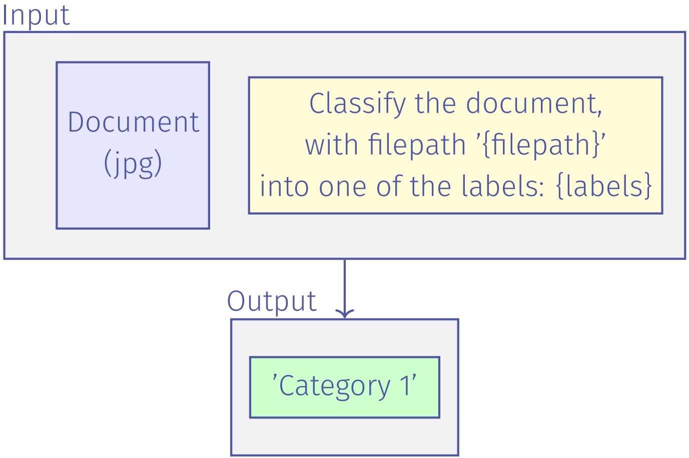
SFT


Input
Document (jpg)
Classify the document, with filepath '{filepath}' into one of the labels: {labels}
Output
'Category 1'

VLM CLASSIFICATION

SFT

Open-source VLMs



Input

Document (jpg)

Classify the document, with filepath '{filepath}' into one of the labels: {labels}

Output

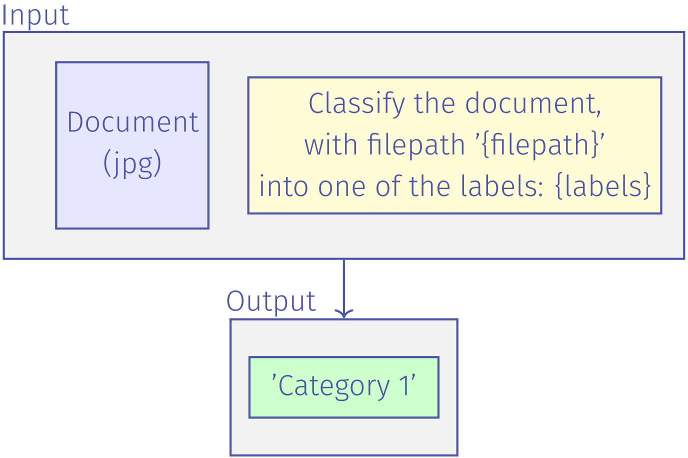
'Category 1'

VLM CLASSIFICATION

SFT

Open-source VLMs

Improved performance



Classify the document, with filepath '{filepath}' into one of the labels: {labels}

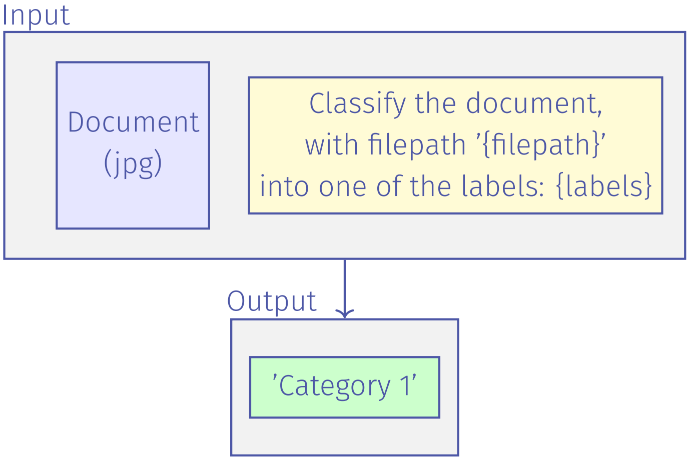
VLM CLASSIFICATION

SFT

Open-source VLMs

Improved performance

How to avoid alignment problems



Input

Document (jpg)

Classify the document, with filepath ’{filepath}’ into one of the labels: {labels}

Output

’Category 1’

VLM DRAWBACKS

VLM DRAWBACKS

Time consuming to set up open-source VLMs

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- Model should be available on platforms like HF

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This makes it costly to test different open-source VLMs

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Compute heavy

VLM DRAWBACKS

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Compute heavy

- High experimentation time for training

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- High experimentation time for training
- Expensive inference

VLM DRAWBACKS

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- Configure dataset into correct format

This makes it costly to test different open-source VLMs

Compute heavy

- High experimentation time for training
- Expensive inference
- Limited number of pages due to compute requirements

Staying up to date

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Newsletters

- TLDR AI
- AlphaSignal

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GitHub stars

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GitHub stars

PapersWithCode

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GitHub stars

PapersWithCode

Specific blogs

- OpenAI
- Anthropic

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GitHub stars

PapersWithCode

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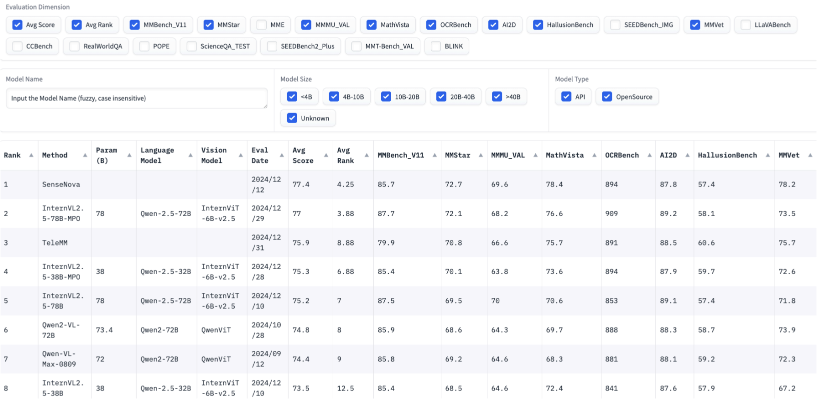
VLM leaderboards (HF)



Evaluation Dimension

☑ Avg Score ☑ Avg Rank ☑ MMBench_V11 ☑ MMStar □ MME ☑ MMMU_VAL ☑ MathVista ☑ OCRBench ☑ AI2D ☑ HallusionBench □ SEEDBench_IMG ☑ MMVet □ LLaVABench □ CCBench □ RealWorldQA □ POPE □ ScienceQA_TEST □ SEEDBench2_Plus □ MMT-Bench_VAL □ BLINK

Model Name

Input the Model Name (fuzzy, case insensitive)

Model Size

☑ <4B ☑ 4B-10B ☑ 10B-20B ☑ 20B-40B ☑ >40B ☑ Unknown

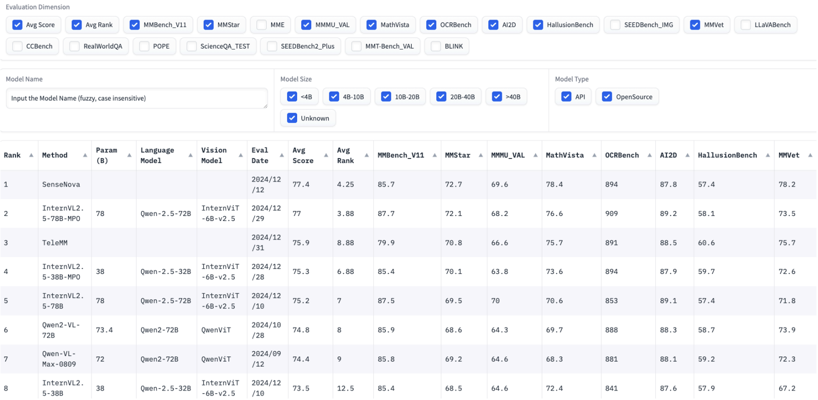
Model Type

☑ API ☑ OpenSource

Rank ▲	Method ▲	Param (B) ▲	Language Model ▲	Vision Model ▲	Eval Date ▲	Avg Score ▲	Avg Rank ▲	MMBench_V11 ▲	MMStar ▲	MMMU_VAL ▲	MathVista ▲	OCRBench ▲	AI2D ▲	HallusionBench ▲	MMVet ▲
1	SenseNova				2024/12/12	77.4	4.25	85.7	72.7	69.6	78.4	894	87.8	57.4	78.2
2	InternVL2.5-78B-MPO	78	Qwen-2.5-72B	InternViT-6B-v2.5	2024/12/29	77	3.88	87.7	72.1	68.2	76.6	909	89.2	58.1	73.5
3	TeleMM				2024/12/31	75.9	8.88	79.9	70.8	66.6	75.7	891	88.5	60.6	75.7
4	InternVL2.5-38B-MPO	38	Qwen-2.5-32B	InternViT-6B-v2.5	2024/12/28	75.3	6.88	85.4	70.1	63.8	73.6	894	87.9	59.7	72.6
5	InternVL2.5-78B	78	Qwen-2.5-72B	InternViT-6B-v2.5	2024/12/10	75.2	7	87.5	69.5	70	70.6	853	89.1	57.4	71.8
6	Qwen2-VL-72B	73.4	Qwen2-72B	QwenViT	2024/10/28	74.8	8	85.9	68.6	64.3	69.7	888	88.3	58.7	73.9
7	Qwen-VL-Max-0809	72	Qwen2-72B	QwenViT	2024/09/12	74.4	9	85.8	69.2	64.6	68.3	881	88.1	59.2	72.3
8	InternVL2.5-38B	38	Qwen-2.5-32B	InternViT-6B-v2.5	2024/12/10	73.5	12.5	85.4	68.5	64.6	72.4	841	87.6	57.9	67.2

STAYING UP TO DATE

- Newsletters
  - TLDR AI
  - AlphaSignal
- GitHub stars
- PapersWithCode
- Specific blogs
  - OpenAI
  - Anthropic
- VLM leaderboards (HF)
- LLM Night



Evaluation Dimension

☑ Avg Score ☑ Avg Rank ☑ MMBench_V11 ☑ MMStar ☐ MME ☑ MMMU_VAL ☑ MathVista ☑ OCRBench ☑ AI2D ☑ HallusionBench ☐ SEEDBench_IMG ☑ MMVet ☐ LLaVABench ☐ CCBench ☐ RealWorldQA ☐ POPE ☐ ScienceQA_TEST ☐ SEEDBench2_Plus ☐ MMT-Bench_VAL ☐ BLINK

Model Name

Input the Model Name (fuzzy, case insensitive)

Model Size

☑ <4B ☑ 4B-10B ☑ 10B-20B ☑ 20B-40B ☑ >40B ☑ Unknown

Model Type

☑ API ☑ OpenSource

Rank ▲	Method ▲	Param (B) ▲	Language Model ▲	Vision Model ▲	Eval Date ▲	Avg Score ▲	Avg Rank ▲	MMBench_V11 ▲	MMStar ▲	MMMU_VAL ▲	MathVista ▲	OCRBench ▲	AI2D ▲	HallusionBench ▲	MMVet ▲
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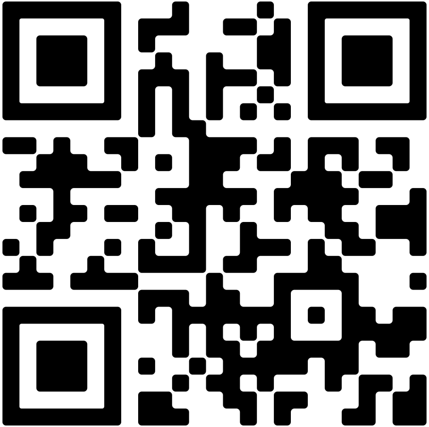
Link to presentations and code



Sources

- Vision Transformer (ViT):
  An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale
- Qwen-VL:
  Qwen-VL: A Versatile Vision-Language Model for Understanding, Generation, and Retrieval
- Qwen-VL-2:
  Qwen2-VL: Enhancing Vision-Language Model's Perception of the World at Any Resolution
- VisionLLaMA:
  VisionLLaMA: A Unified LLaMA Backbone for Vision Tasks
- Pixtral:
  Pixtral 12B

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