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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- Main focus on AI
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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

Overview

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The power of VLMs

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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

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VLM Drawbacks

Staying up to date with VLM advances

License Plate Recognition

+

Provide the full license plate number

License Plate Recognition

+

Provide the full license plate number

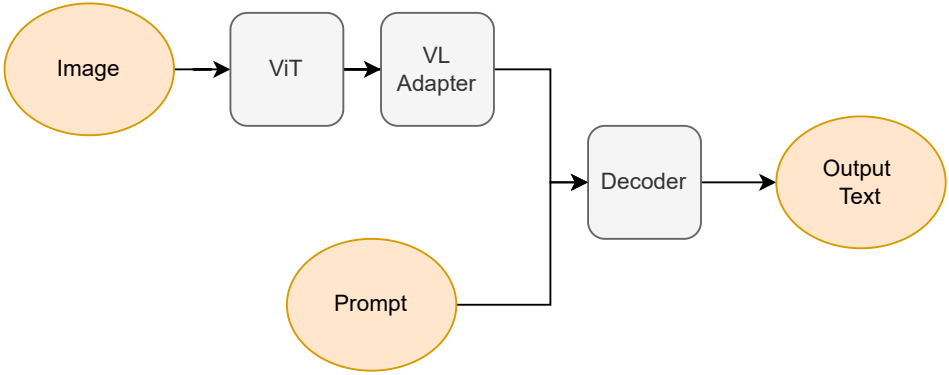
↓

The full license plate number is AB12345.

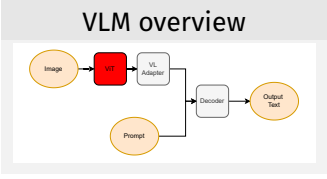
Performed with Qwen2-VL-7B-Instruct

Intro to VLMs

How do they work



How vision integrates in VLMs - ViT



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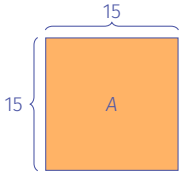
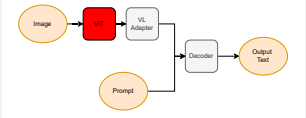


VLM overview



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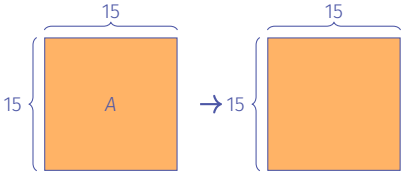

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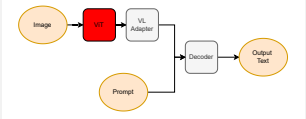

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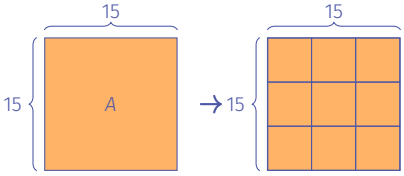

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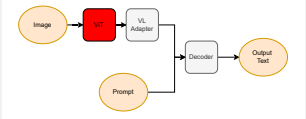

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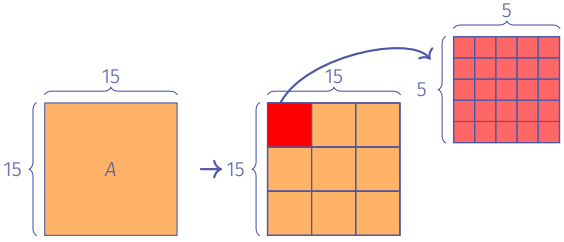

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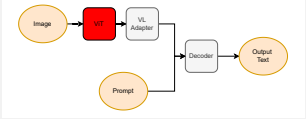

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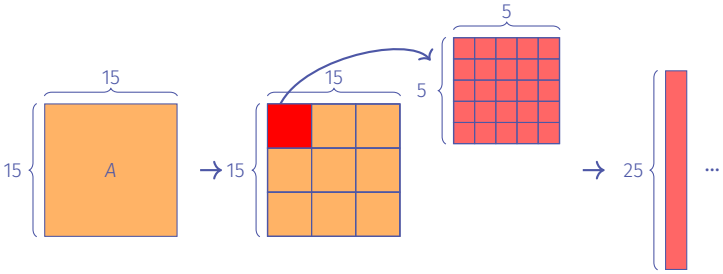

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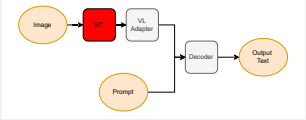

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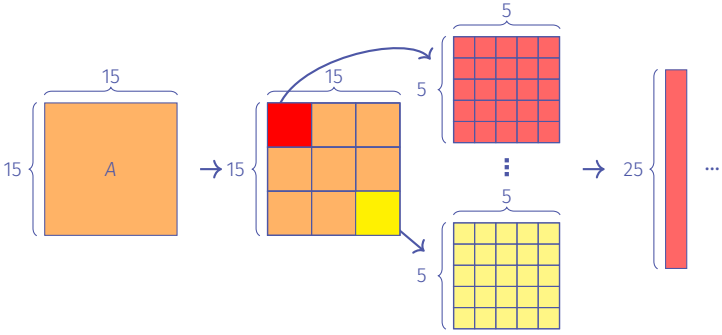

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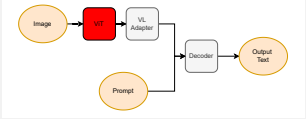

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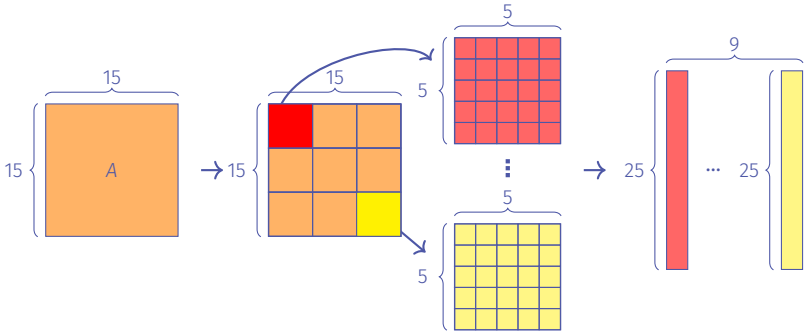

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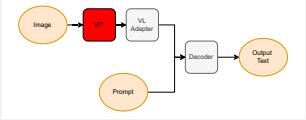

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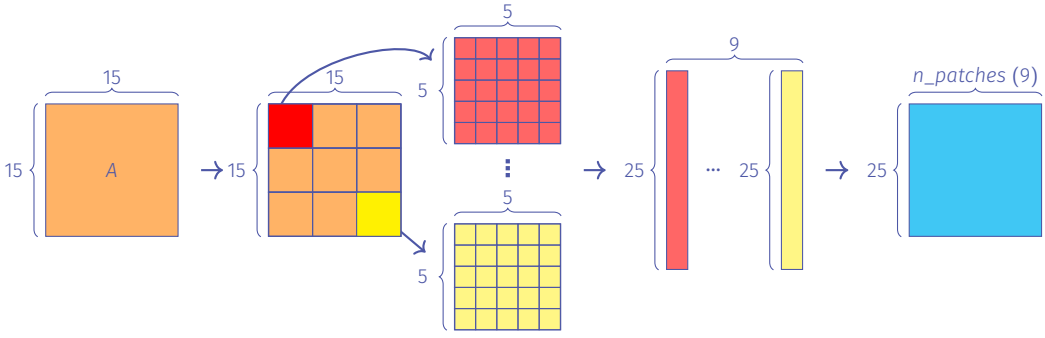

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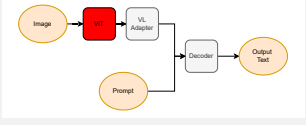
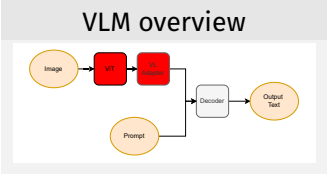


How vision integrates into the LLM - Transformer layers



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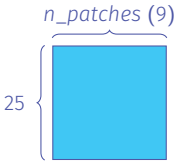

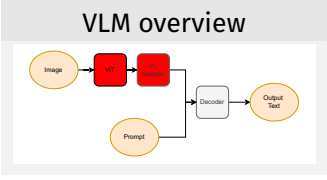

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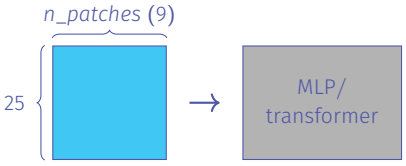

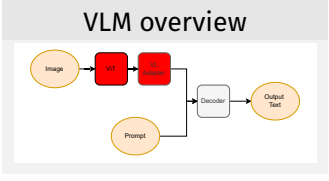

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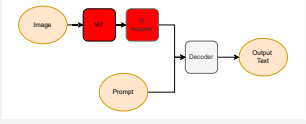

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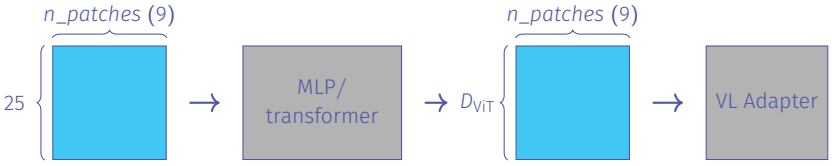

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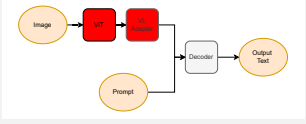

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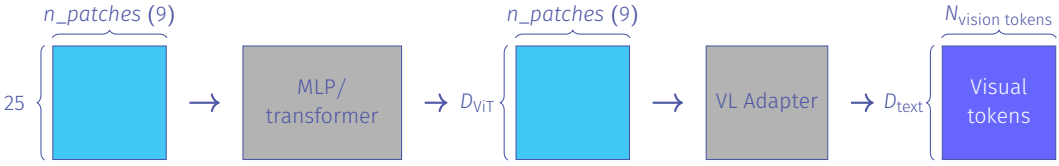

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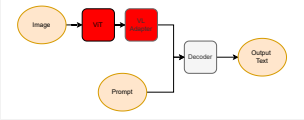

Decoder input sequence

Prompt

Describe this image 

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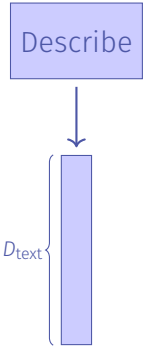

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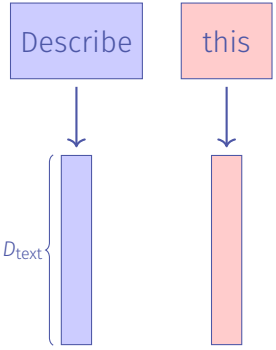

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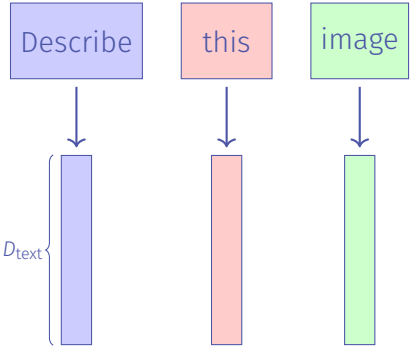

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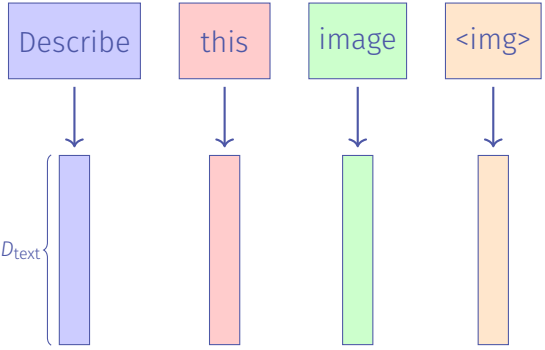

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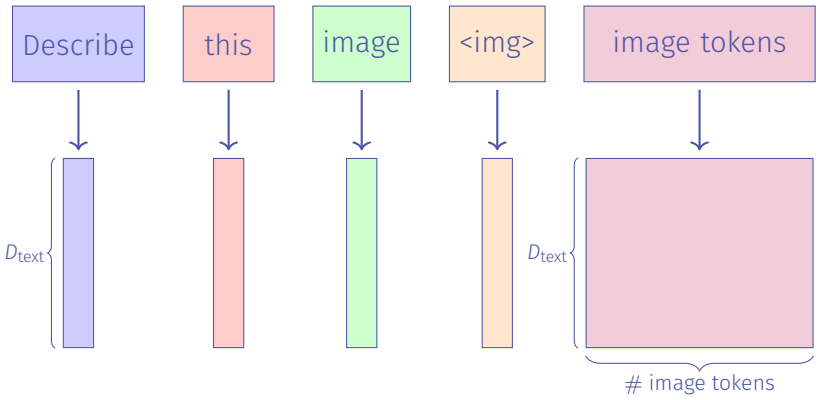

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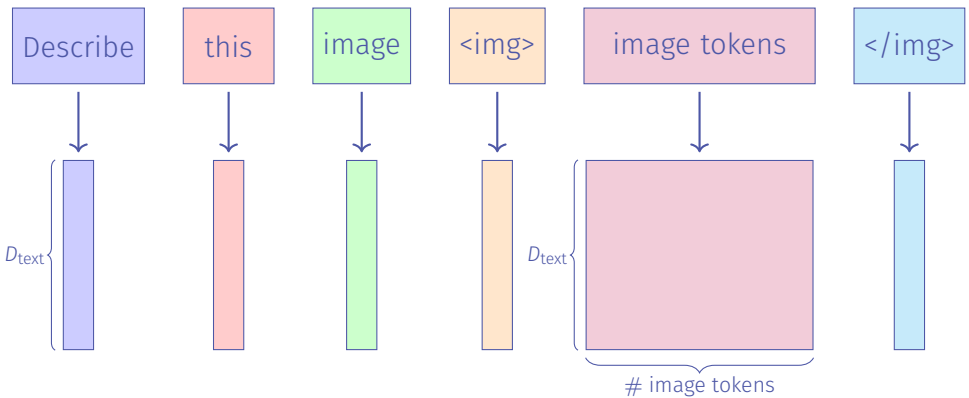
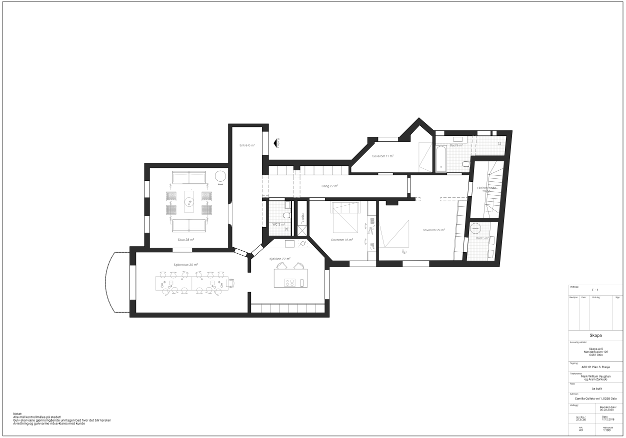


ARK DRAWING EXAMPLE



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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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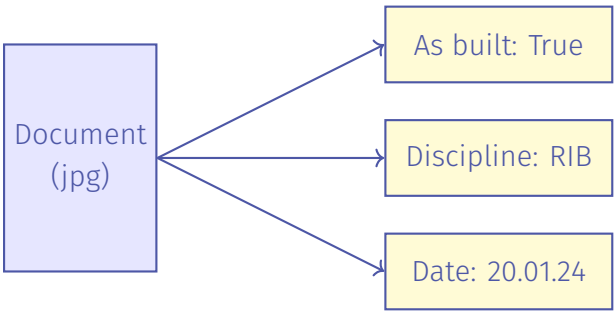

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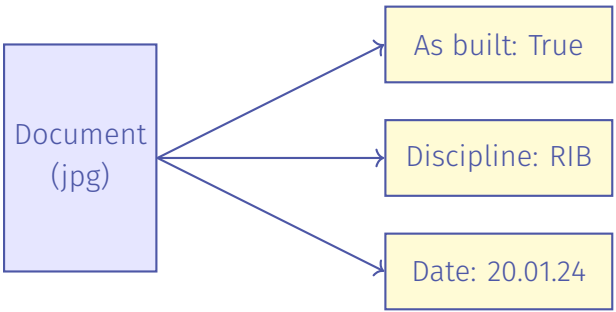
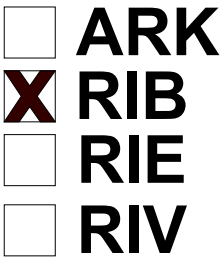


Textual task requiring visual info



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

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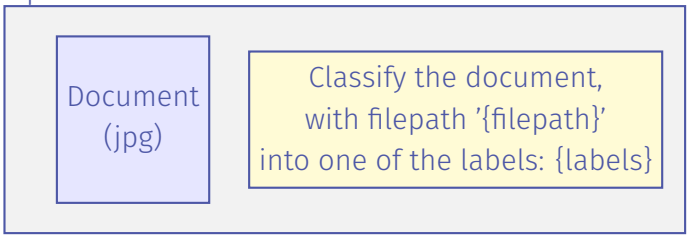
SFT

VLM CLASSIFICATION

SFT

Input



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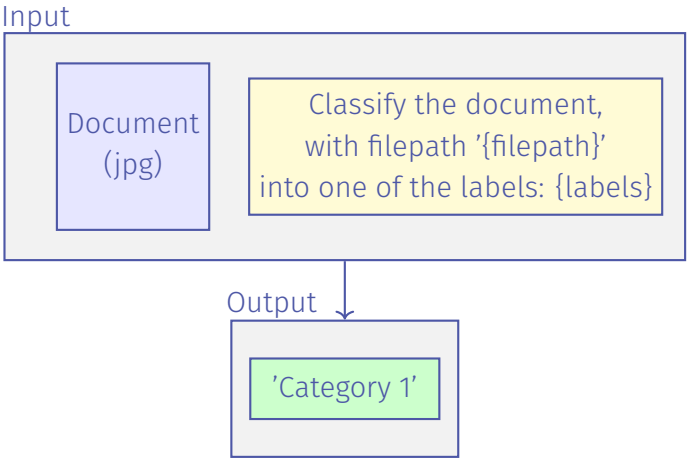
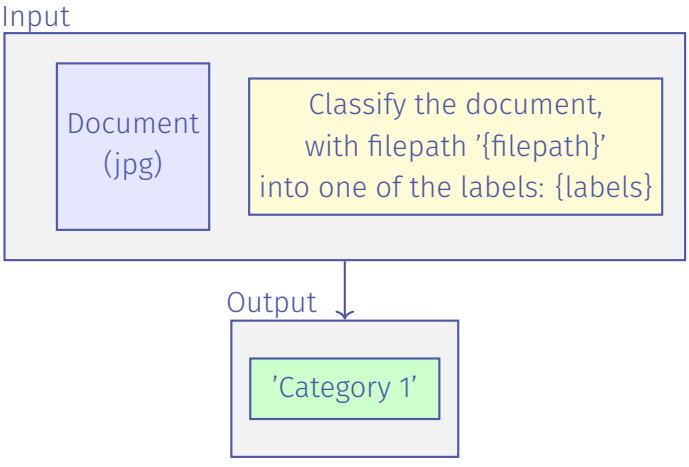


VLM CLASSIFICATION

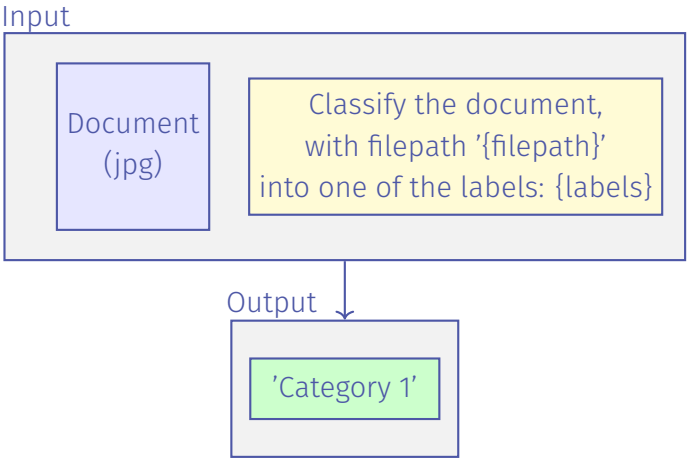
SFT

Open-source VLMs



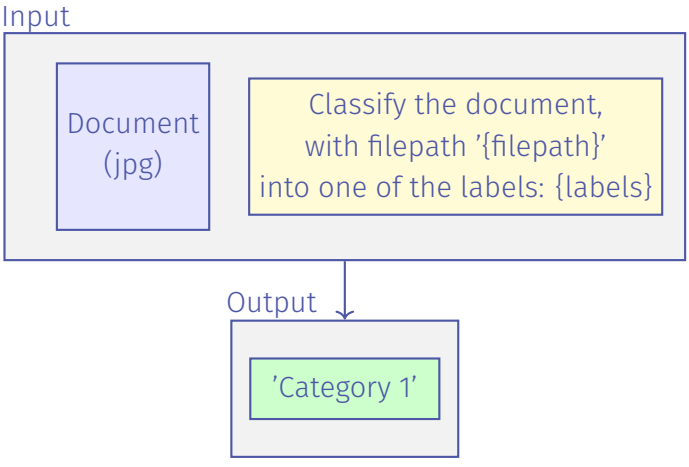
VLM CLASSIFICATION

- SFT
- Open-source VLMs
- Improved performance



VLM CLASSIFICATION

- SFT
- Open-source VLMs
- Improved performance
- How to avoid hallucinations



VLM DRAWBACKS

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Time consuming to set up open-source VLMs

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- Model should be available on platforms like HF

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- Often niche package criteria

VLM DRAWBACKS

Time consuming to set up open-source VLMs

- Model should be available on platforms like HF
- Often niche package criteria
- Configure dataset into correct format

VLM DRAWBACKS

Time consuming to set up open-source VLMs

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- Often niche package criteria
- Configure dataset into correct format

This makes it costly to test different open-source VLMs

VLM DRAWBACKS

Time consuming to set up open-source VLMs

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Compute heavy

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Compute heavy

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- Expensive inference
- Limited number of pages due to compute requirements

Staying up to date

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Newsletters

- TLDR AI
- AlphaSignal

Staying up to date

Newsletters

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GitHub stars

Staying up to date

Newsletters

- TLDR AI
- AlphaSignal

GitHub stars

PapersWithCode

Staying up to date

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  - AlphaSignal
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- Specific blogs
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Staying up to date

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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

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Evaluation Dimension

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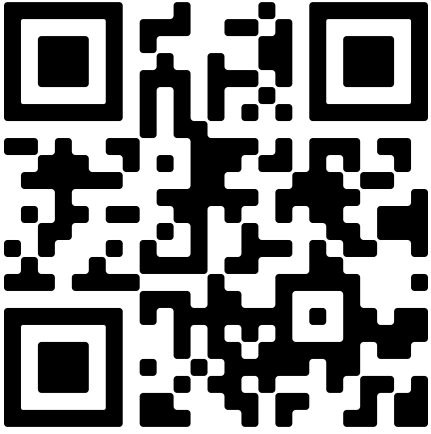
Link to presentations and code



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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