

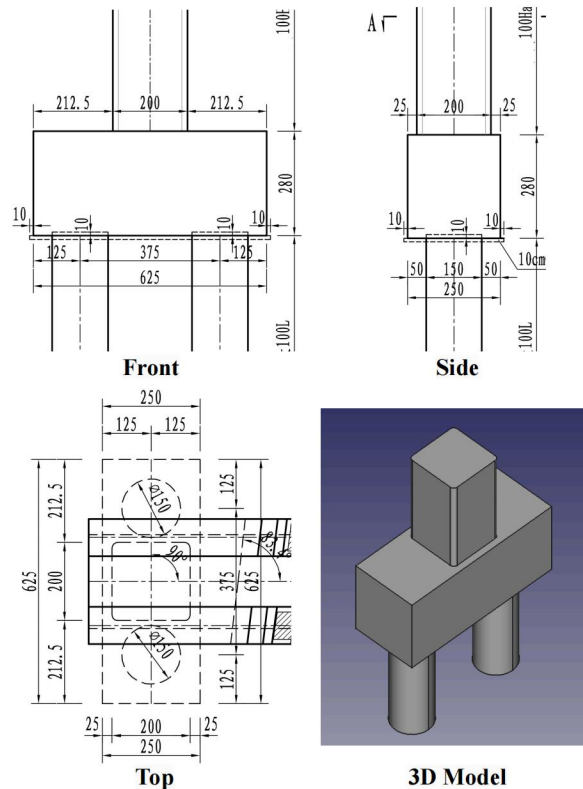


Presentation for CReFT-CAD

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CReFT-CAD: Boosting Orthographic Projection Reasoning for CAD via Reinforcement Fine-Tuning

● Problem Statement:



Given the front, top, and side views, please output the numeric values of the following parameters in this exact order ..., separated by commas.

Wrong Answer! 530, 540, 1, 3 ..., 208, 224, 391

(a) Qwen2.5-VL (without tuning) for Full Parameter List Output

Given the front, top, and side views, please output the numeric values of the following parameters in this exact order ..., separated by commas.

Wrong Answer! 590, 560, 2, 2 ..., 208, 224, 391

(b) Deepseek (without tuning) for Full Parameter List Output

Given the front, top, and side views, please output the numeric values of the following parameters in this exact order ..., separated by commas.

2*97+2*194+146, 2*379+210, 1, 3 ..., 208, 224, 391

(c) CReFT-CAD for Full Parameter List Output

Given the <image>, is the Pier Column Cross-Bridge Dimension equal to 210?

No, the correct answer is 194.

(d) CReFT-CAD for Parameter Validation

Given the top view <image>, and front view <image>, which one <image> is the right side view?

The right side view is <image>.

(e) CReFT-CAD for View Matching

Given the front, top, and side views<image>, what is the quantity of pile bases and pier column?

The quantity of pile base is 6, the quantity of pier column is 2.

(f) CReFT-CAD for Component Counting

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● Our Solution - CReFT-CAD:

Training Tasks	Input Prompt	Response
Dichotomous choice task	<i>Given the front, top, and side views, please refer to the required field names below, and determine whether the given parameter values ...match the image.</i>	Yes/NO
Multiple choice task	<i>Given the front, top, and side views, please refer to the required field names below, and choose all options that match the image. ...Options: A. 860, 833, ..., 356 B. 860, <mask>, ..., 356 C... D ...</i>	A/B/C/D
Parameterization task based on CoT	<i>Given the front, top, and side views, please output only the numeric values of the following parameters in this exact order..., separated by commas.</i>	2*82+2*188+148, 2*398+160, ..., 222

$$R_{P1} = \begin{cases} 1, & \text{if all parameters are correct} \\ 0, & \text{otherwise} \end{cases}$$

$$R_{P2} = \begin{cases} 1 & \text{if } S_{\text{selected}} = S_{\text{correct}} \\ 0.2 & \text{if } S_{\text{selected}} \supseteq S_{\text{correct}} \text{ but } S_{\text{selected}} \neq S_{\text{correct}} \\ 0 & \text{if } (S_{\text{selected}} \cap S_{\text{correct}} \neq \emptyset) \text{ and } (S_{\text{selected}} \cap S_{\text{incorrect}} \neq \emptyset) \\ 0 & \text{if } S_{\text{selected}} = S_{\text{incorrect}} \end{cases}$$

$$R_{P3} = \begin{cases} 1 & \text{if the model correctly predicts an easy attribute} \\ 1.5 & \text{if the model correctly predicts a medium attribute} \\ 2 & \text{if the model correctly predicts a hard attribute} \\ 0 & \text{if the model's prediction is incorrect} \end{cases}$$

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- TriView2CAD

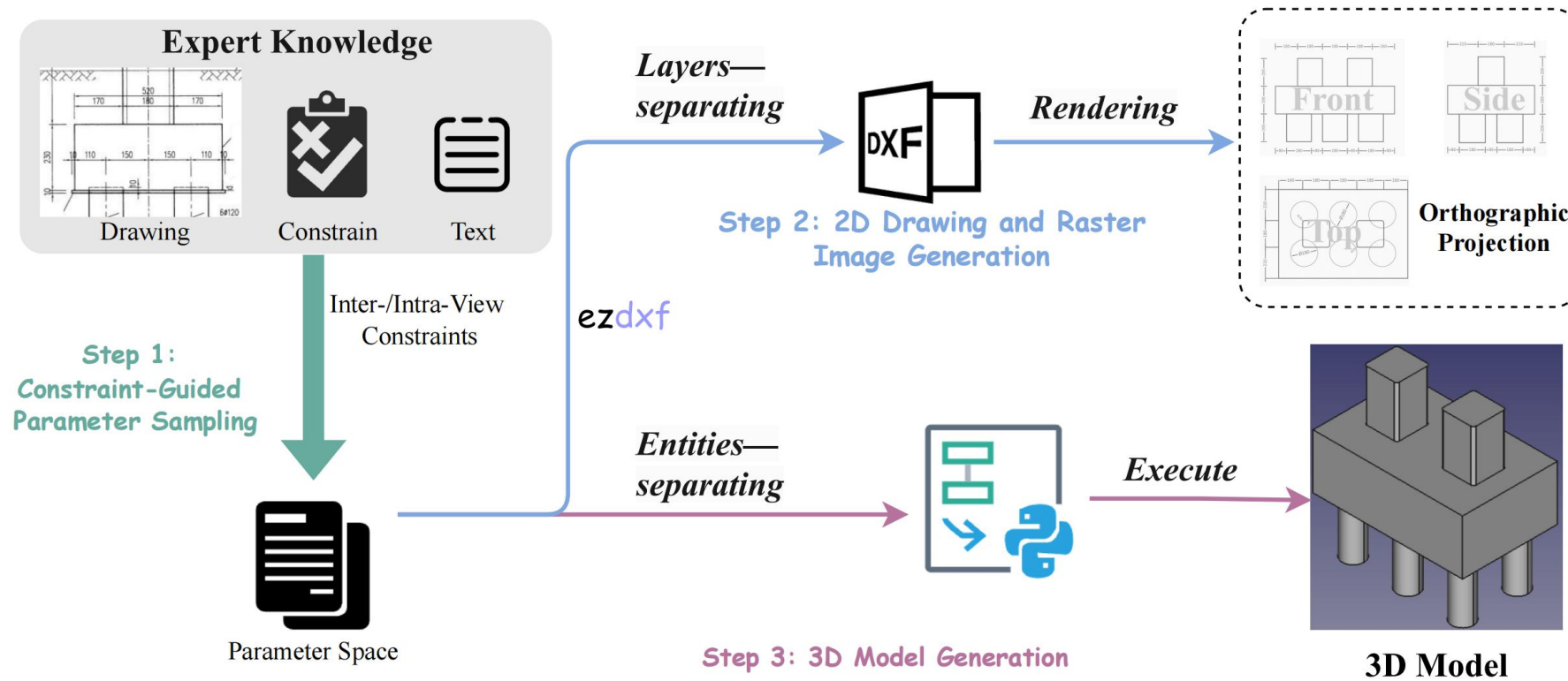


Figure 2: Constraint-driven synthesis pipeline for TriView2CAD.

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- Result

Table 1: Performance comparison of various VLMs on orthographic projection reasoning tasks.

PROMPTS	Without Reasoning Guidance				Reasoning Guidance			
	Test Img	+Reference	+Answered	+Attribute	Test Img	+Reference	+Answered	+Attribute
		Img	Pair	Explanation		Img	Pair	Explanation
Phi-3.5-Vision [36]	4.22	8.95	8.05	6.26	11.32	14.40	16.16	15.79
LLaVA-OneVision [37]	9.16	16.06	15.65	14.84	9.10	16.81	16.21	20.53
DeepSeek-VL [38]	8.16	22.68	20.03	12.65	14.02	20.31	24.62	25.45
InternVL2.5 [39]	15.79	18.82	23.30	17.16	15.63	22.35	24.47	23.73
InternVL3 [39]	15.46	17.90	22.44	17.91	15.81	21.98	23.58	17.05
Qwen2.5-Omni [40]	23.43	28.89	28.74	26.50	26.12	30.93	29.40	35.71
Qwen2.5-VL [41]	24.54	30.76	30.47	25.86	24.54	32.78	33.64	38.88
Ours	80.86	82.99	83.24	82.67	81.35	83.11	82.87	84.03



THANKS

请各位老师同学批评指正