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Iris: a multi-constraint graphic layout generation system

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Key words: Graphic layout generation; Deep generative model; Layout design system

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Motivation

- Graphic designers typically need to create layouts with intra- and inter-domain constraints. For instance, in a poster design task, the product subject to be showcased is fixed, serving as the inter-domain constraint in the form of a background image. Concurrently, the quantity and category of design elements employed to convey supplementary subject information or augment visual appeal are pre-determined, generally forming the intra-domain constraint. However, existing methods fail to satisfy the precise constraints stipulated by designers.
- Existing studies fall short in providing an interactive platform that aids designers in efficiently completing this design process.

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Main idea

- We propose the multi-constraint LayoutVQ-VAE for layout generation constrained on element categories and the background image. The model learns a discrete latent representation of layouts and uniformly serializes constraints from different domains, which is a novel approach that facilitates modeling the relationship between layouts and multiple constraints.
- We propose Iris, a user-centered, intelligent layout generation system. It assists designers throughout the workflow, covering input specification, layout generation, custom editing, and final rendering, and accommodates a wide variety of design scenarios, including posters, magazines, and user interfaces.

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Framework

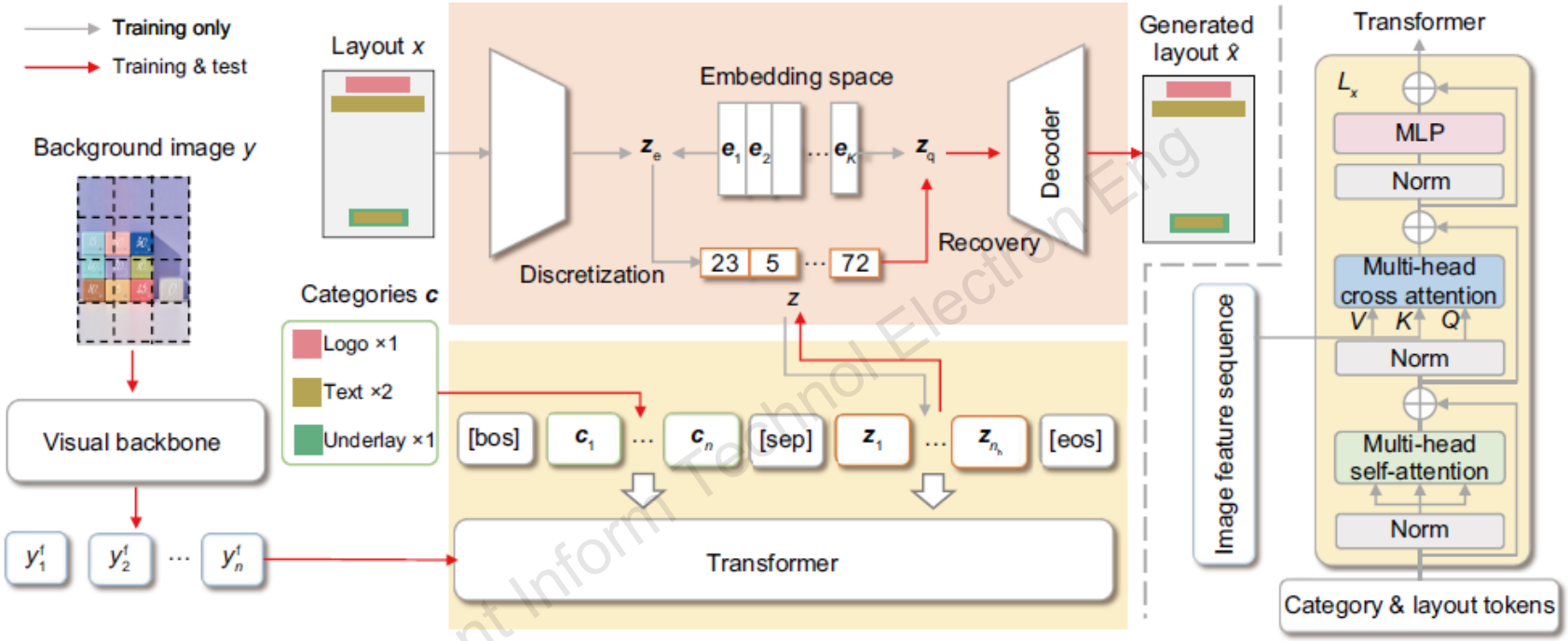

Fig. 2 Overview of multi-constraint LayoutVQ-VAE (MLP: multi-layer perceptron. References to color refer to the online version of this figure)

Our model employs a VQ-VAE architecture to learn the discrete latent representation of layouts, serializes the element categories and background image, and adopts a Transformer to model the relationship between the constraints and layout representation.

System

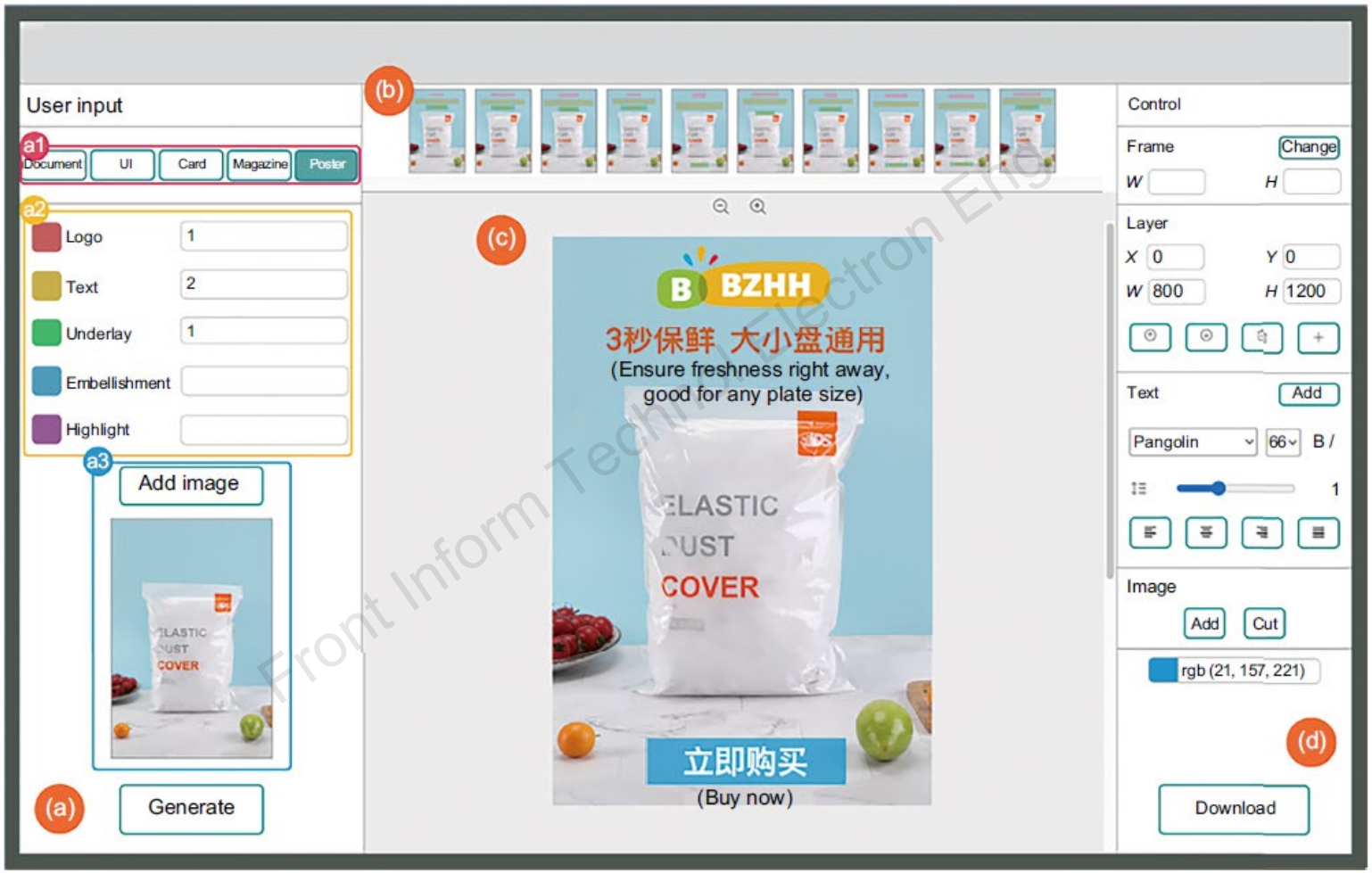

Fig. 5 Iris user interface consisting of a user input panel (a), a list of generated layouts (b), a canvas panel (c), and an edit panel (d)

Results

Table 3 Quantitative comparison in layout generation with intra-domain constraints

Method	PubLayNet				Rico			
	FID↓	MaxIoU↑	Alignment↓	Overlap↓	FID↓	MaxIoU↑	Alignment↓	Overlap↓
LayoutTransformer	20.61	0.33	**0.0013**	**0.11**	10.13	0.36	0.0057	**0.63**
LayoutGAN++	23.72	0.34	0.0019	0.16	13.58	0.36	0.0060	0.66
LayoutDM	**14.19**	**0.39**	0.0019	0.16	7.34	0.39	0.0038	0.67
Ours	20.25	**0.39**	0.0014	0.22	**6.26**	**0.47**	**0.0029**	0.85
Real data	–	–	0.0004	0.0022	–	–	0.0026	0.51

The values displayed in bold represent the optimal results, whereas those underlined denote the suboptimal results. An upward arrow indicates that higher values represent better performance, while a downward arrow indicates that lower values represent better performance

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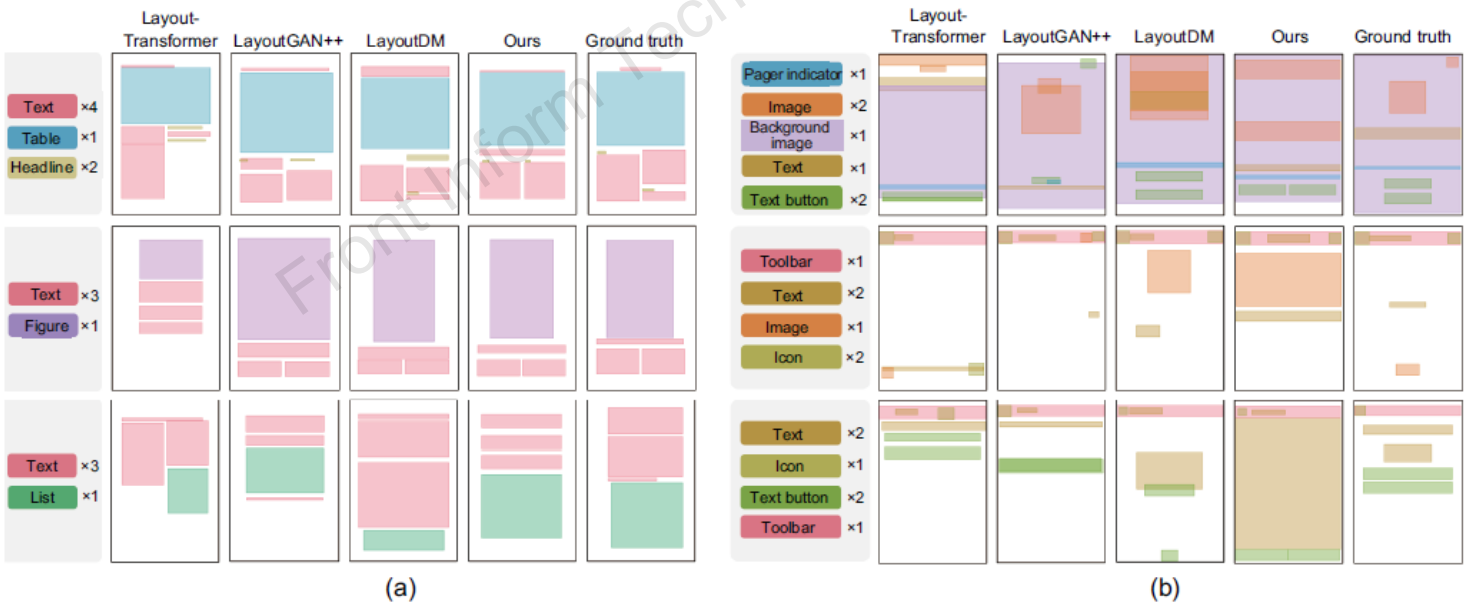

Fig. 3 Qualitative comparison in layout generation with intra-domain constraints: (a) PubLayNet; (b) Rico

Results

Table 4 Quantitative comparison in layout generation with intra- and inter-domain constraints

Method	Text readability↓	Product presentation↓	Alignment↓	Overlap↓
LayoutTransformer	39.94	1.237	**0.0064**	0.0043
ContentGAN	36.88	1.010	0.0072	**0.0035**
CGL-GAN	34.01	0.816	0.0098	0.0256
PDA-GAN	33.55	0.688	0.0105	0.0290
Ours	**29.94**	**0.683**	**0.0064**	0.0206

The values displayed in bold represent the optimal results, whereas those underlined denote the suboptimal results. A downward arrow indicates that lower values represent better performance

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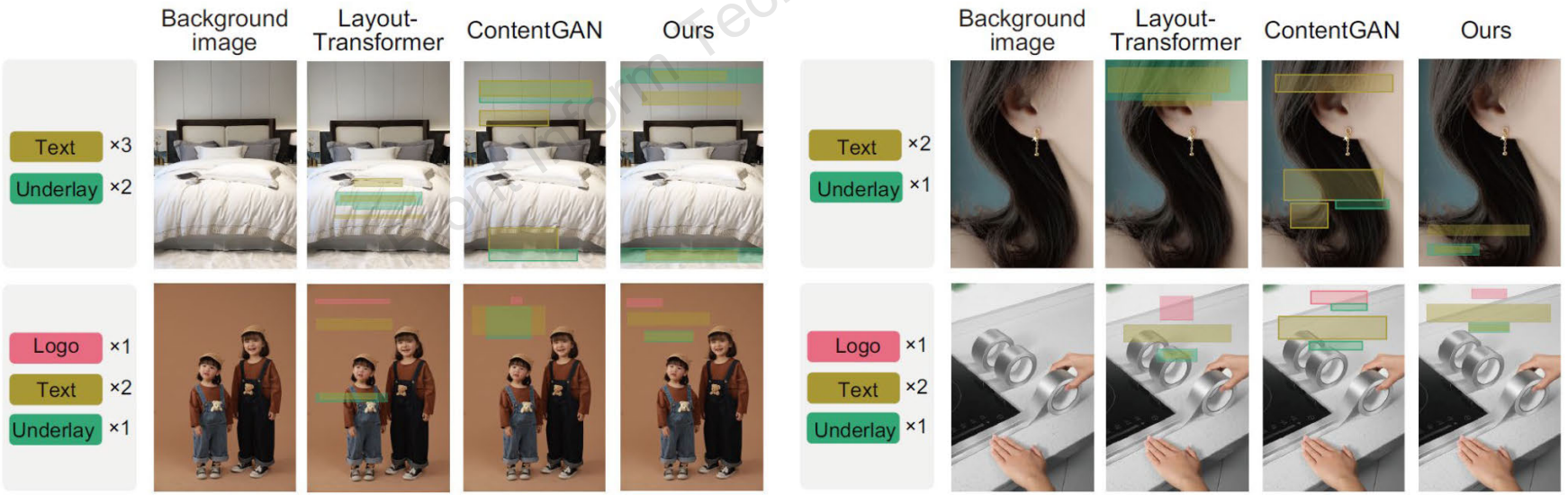

Fig. 4 Qualitative comparison in layout generation with intra- and inter-domain constraints

Results

Fig. 7 Examples for the posters and magazines designed by the designer, Luban/template, and Iris groups in phase 1

Results

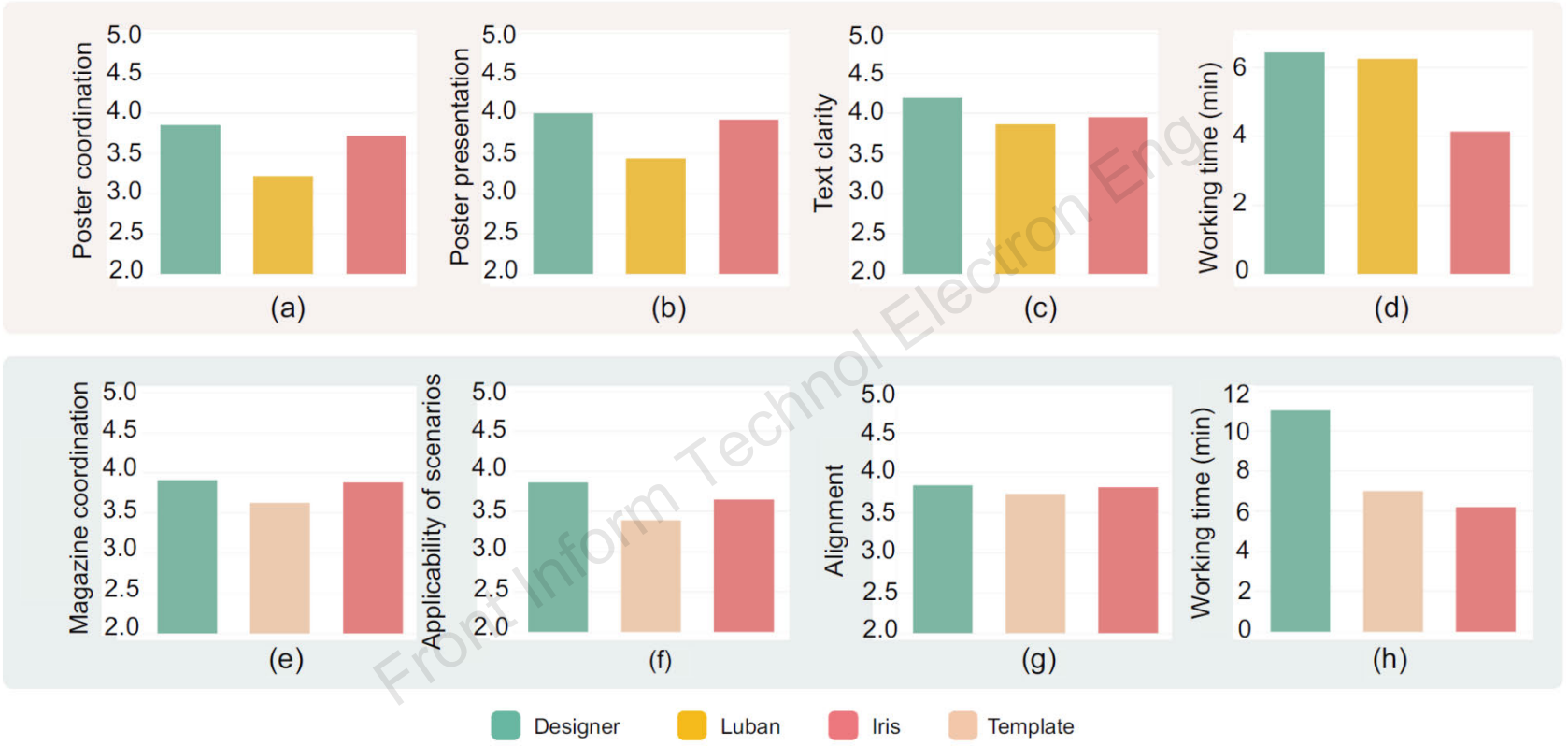

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Fig. 8 Results of phase 2 by designers: (a) average rating for poster coordination using a five-point Likert scale; (b) average rating for satisfaction with the visual presentation of the poster; (c) average rating for clarity of conveyed text information on the poster; (d) average time to create a poster; (e) average rating for magazine layout coordination; (f) average matching rate between magazine layout and target scenarios; (g) average rating for alignment of layout elements in magazines; (h) average time to create a magazine layout

Conclusions

In this work, we propose a novel layout generative model, multi-constraint LayoutVQ-VAE, to address the challenge of layout generation with both intra-domain constraint (element categories) and inter-domain constraint (background image). The quantitative and qualitative results demonstrate that our model outperforms or is on par with previous methods, and can generate layouts characterized by excellence in terms of visual performance and aesthetics. We also introduce Iris, an intelligent layout generation system for designers based on our model. User studies in two different design scenarios demonstrate that our model's output features good comparability with human-designed layouts, significantly reducing the workload and improving design efficiency.

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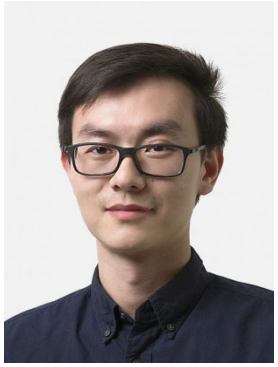

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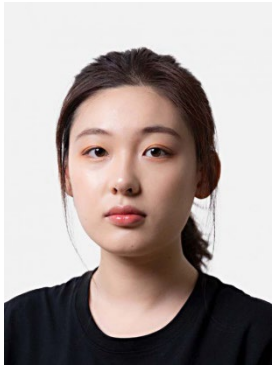

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