JUNE 18-22, 2023
CVPR
VANCOUVER, CANADA

WED-PM-185

Towards Flexible Multi-modal Document Models

(Highlight)

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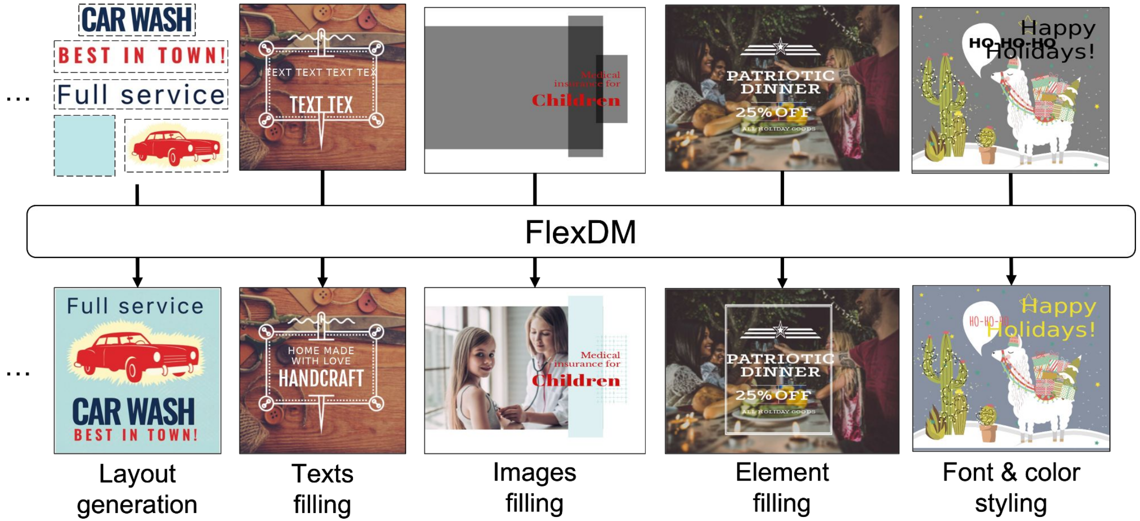
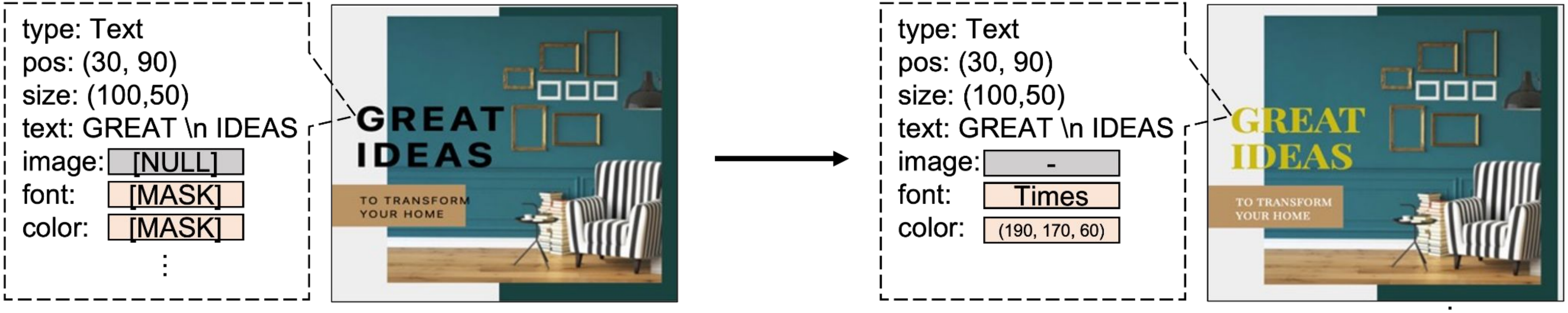
Flexible Document Model (FlexDM)

Our work: solve many design tasks in a single model



Key Idea of FlexDM

Multi-modal masked field prediction as a unified interface



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⋮

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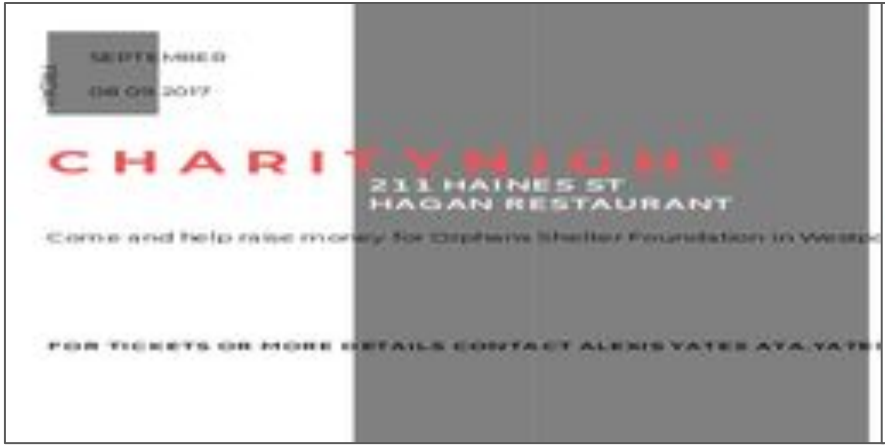
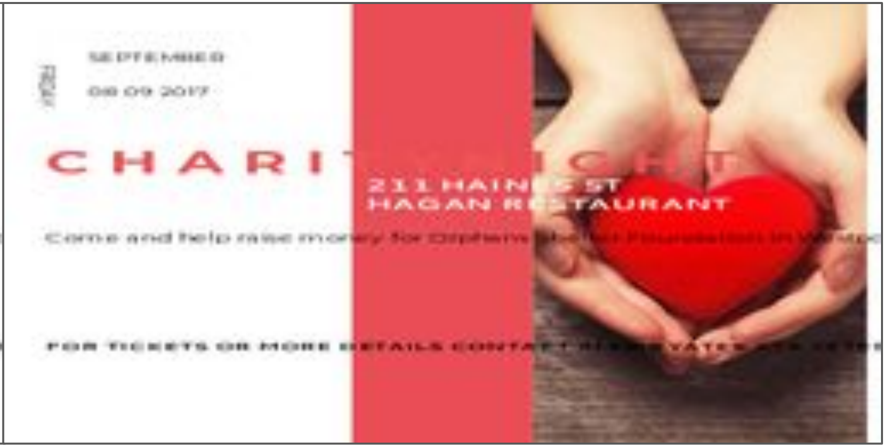
FlexDM Results

Input


FRIDAY
SEPTEMBER
08 09 2017
CHARITY NIGHT
211 HAINES ST
HAGAN RESTAURANT
Come and help raise money for Orphans Shelter Foundation in Westpo
FOR TICKETS OR MORE DETAILS CONTACT ALEXIS YATES ATA.YATE

Output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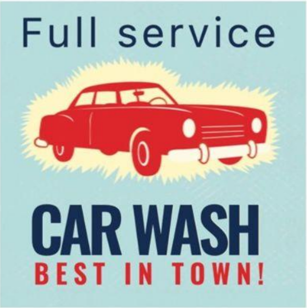
Vector Graphic Document

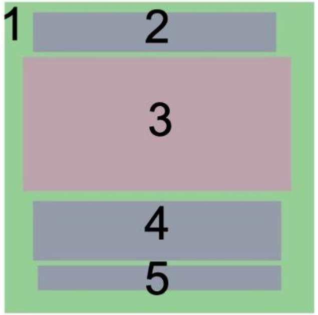
- A data format for making visual design (e.g., banner by Photoshop)
- Consists of a set of visual elements (+ global info) [Yamaguchi+, ICCV'21]
- Scalable, editable, human-interpretable

Rendering

Image



Layout



Vector graphic format

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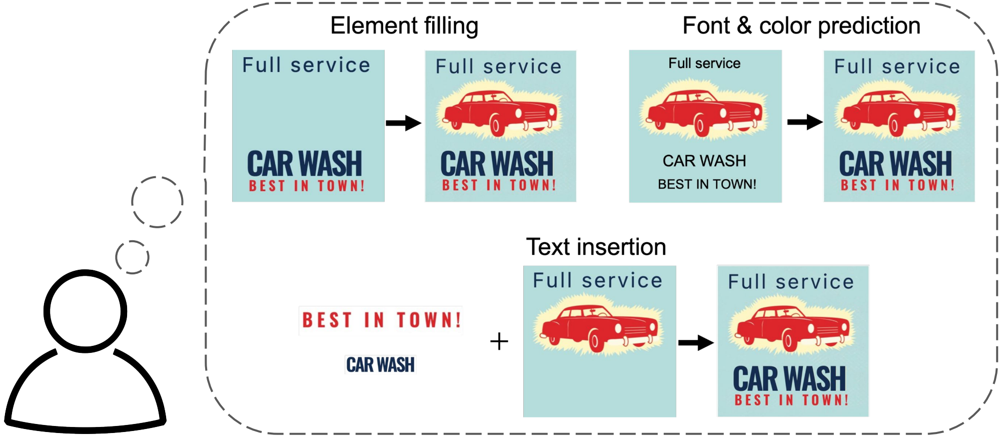
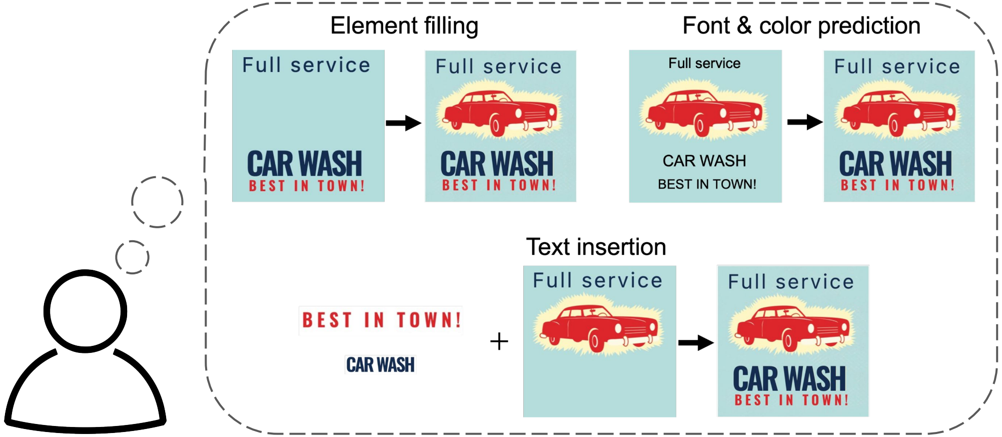
Design Tasks in Iterative Design Process



Design Tasks in Iterative Design Process

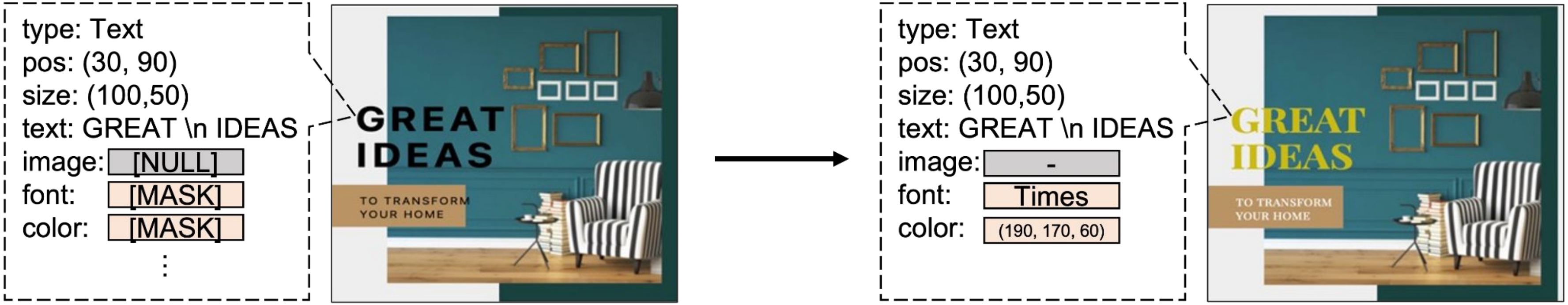
- High variety of possible actions
- Complex interaction between multi-modal elements

→ We handle design tasks in a principled manner



Masked Field prediction (MFP)

- **Predicting arbitrary number of fields hidden by [MASK]**
- **Challenges**
  - How to encode/decode various type of fields?
  - How to handle larger number of fields?



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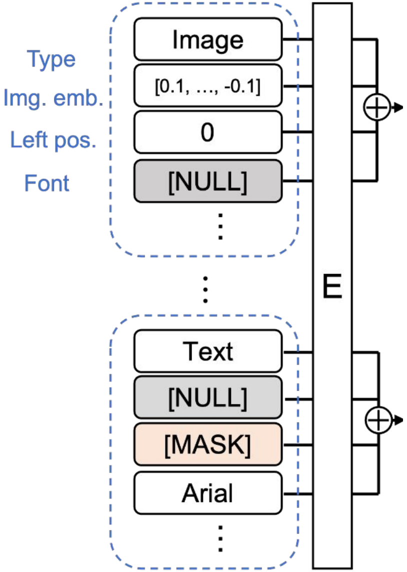
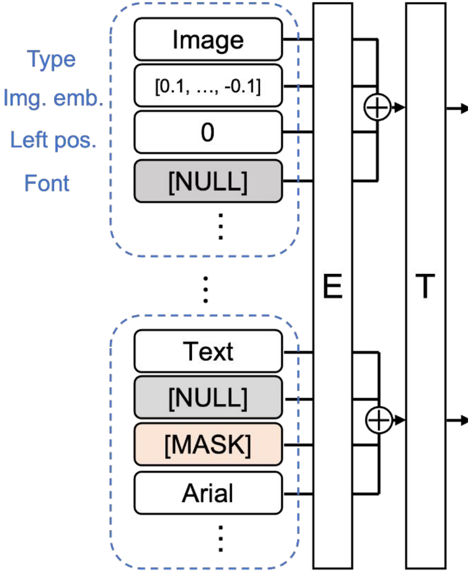
type: Text
pos: (30, 90)
size: (100,50)
text: GREAT \n IDEAS
image: -
font: Times
color: (190, 170, 60)

Network for Masked Field Prediction (MFP)



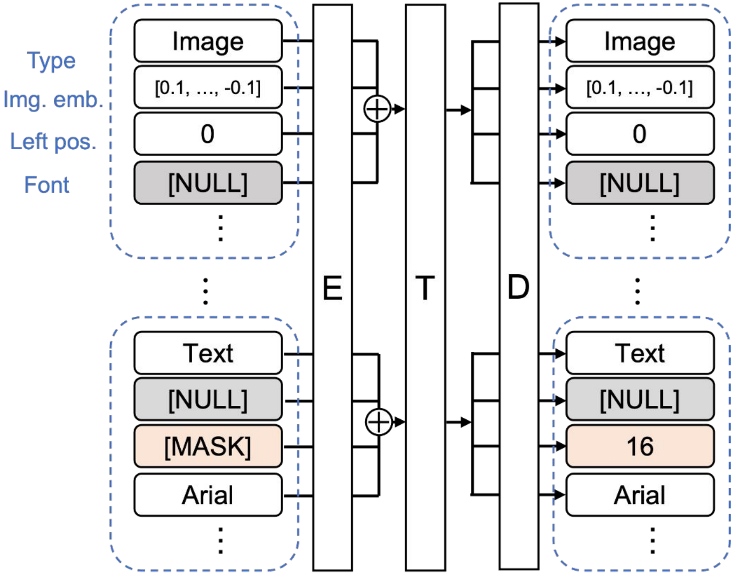
E: encoder

Network for Masked Field Prediction (MFP)



E: encoder, T: Transformer encoder

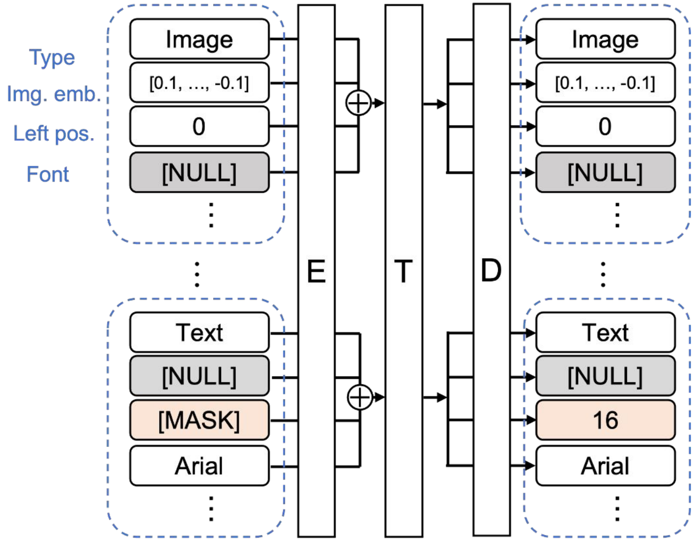
Network for Masked Field Prediction (MFP)



E: encoder, T: Transformer encoder, D: decoder

Challenges and solutions in MFP

- Various type of fields → attribute-specific enc. and dec.
- Large number of fields → consider interaction only in element-level



Training FlexDM

Training

1. In-domain pre-training (15% random masking)
2. Explicit multi-task learning for target design tasks

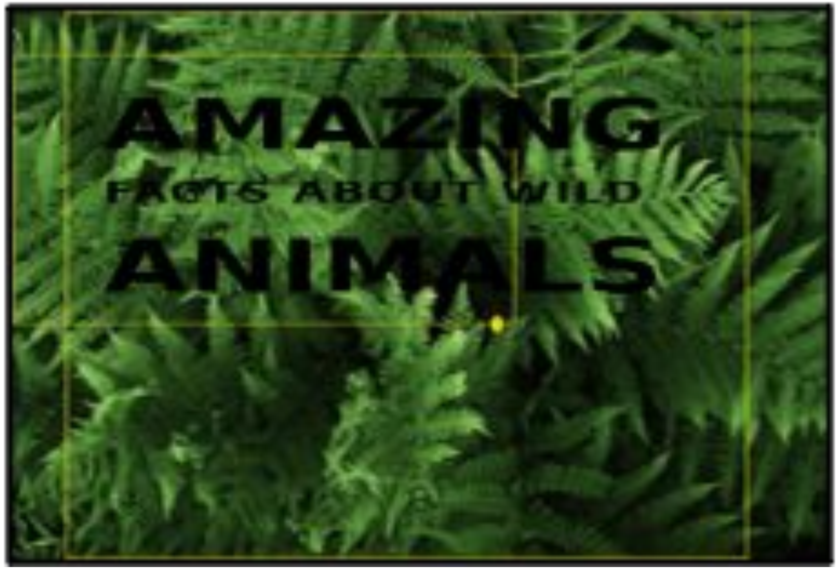
Loss: reconstruction error

Preprocess

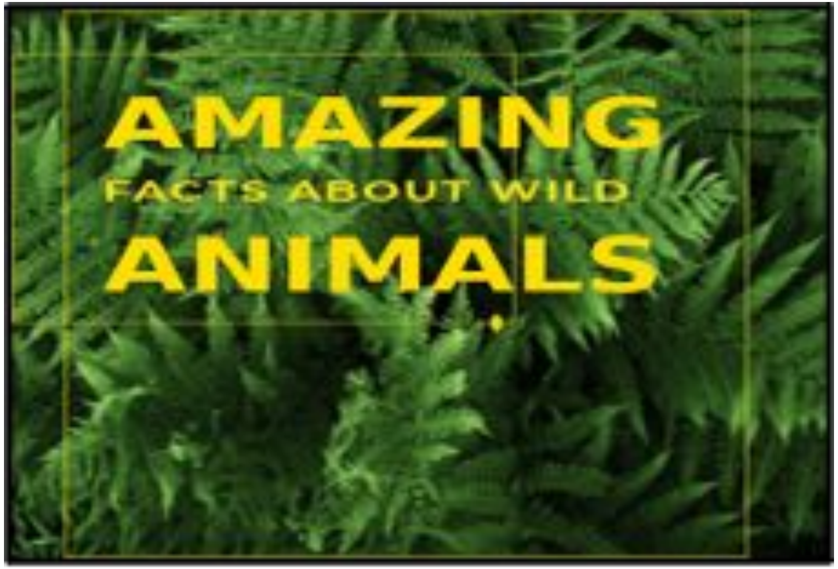
- Quantization for numerical attributes
- Feature extraction using pre-trained models for image and text

Attributes Prediction (ATTR)

Input

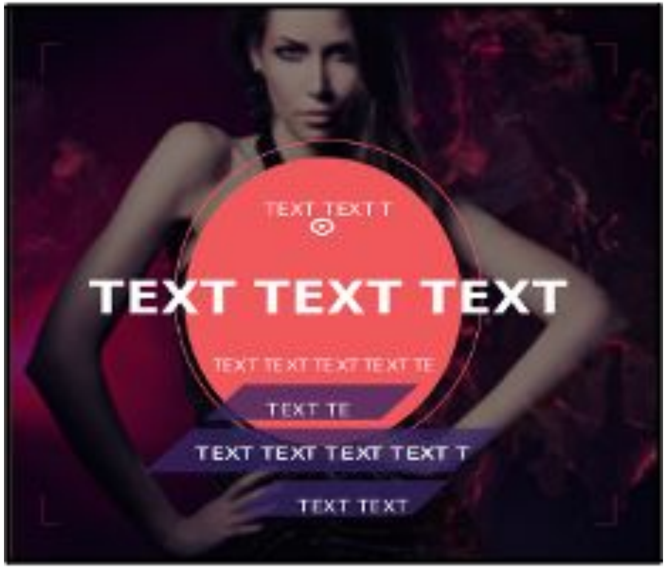


Output

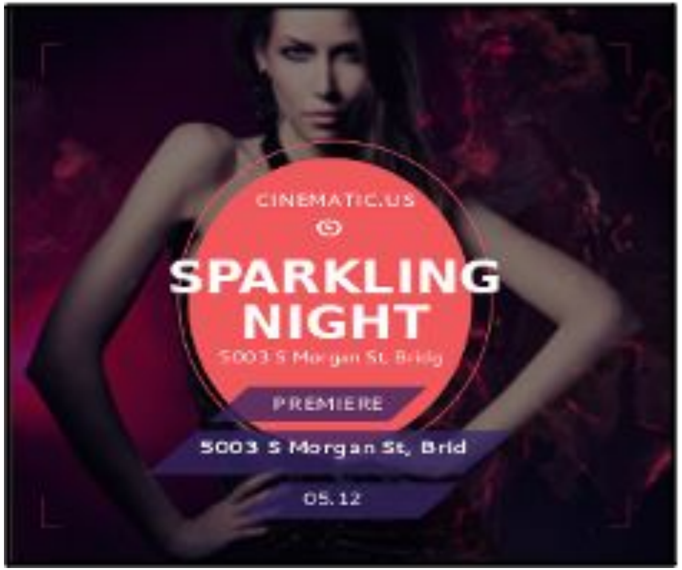


Texts Prediction (TXT)

Input

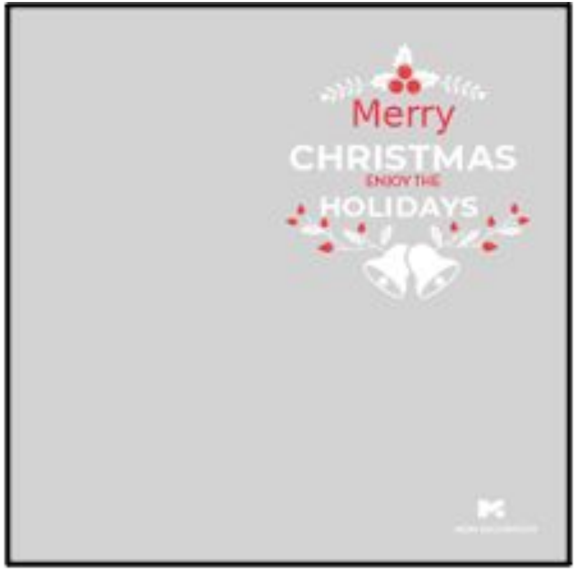


Output

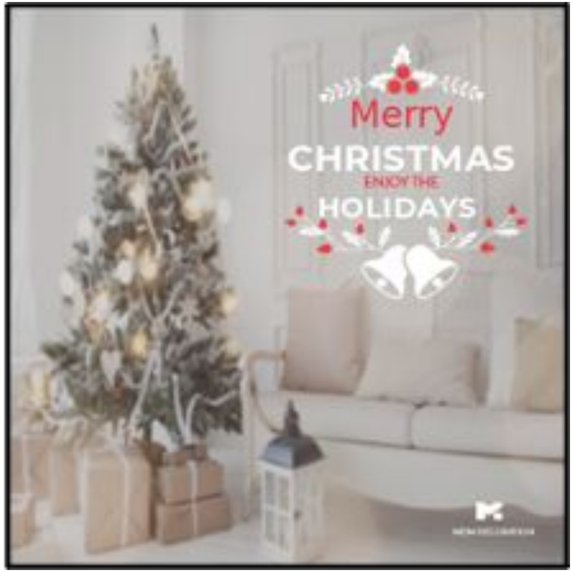


Element Filling (ELEM)

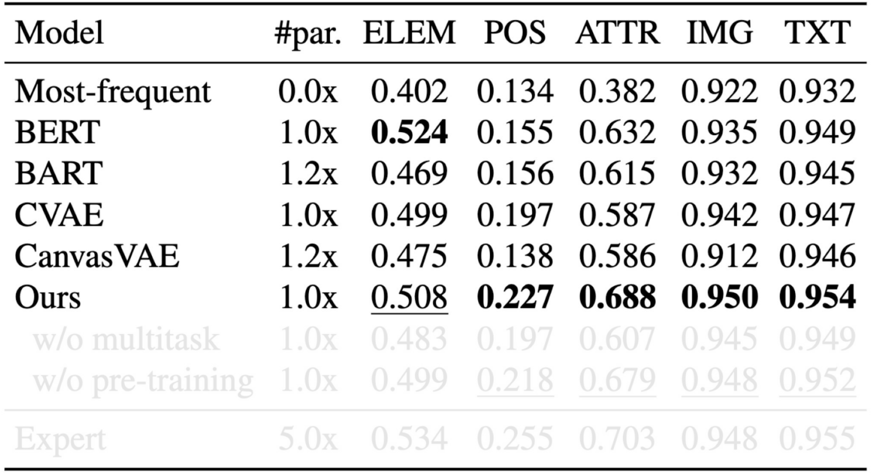
Input



Output



Quantitative Evaluation in Crello



Model	#par.	ELEM	POS	ATTR	IMG	TXT
Most-frequent	0.0x	0.402	0.134	0.382	0.922	0.932
BERT	1.0x	**0.524**	0.155	0.632	0.935	0.949
BART	1.2x	0.469	0.156	0.615	0.932	0.945
CVAE	1.0x	0.499	0.197	0.587	0.942	0.947
CanvasVAE	1.2x	0.475	0.138	0.586	0.912	0.946
Ours	1.0x	0.508	**0.227**	**0.688**	**0.950**	**0.954**
w/o multitask	1.0x	0.483	0.197	0.607	0.945	0.949
w/o pre-training	1.0x	0.499	0.218	0.679	0.948	0.952
Expert	5.0x	0.534	0.255	0.703	0.948	0.955

1. Much better than baselines
2. Almost close to task-specific expert
3. Both components are important

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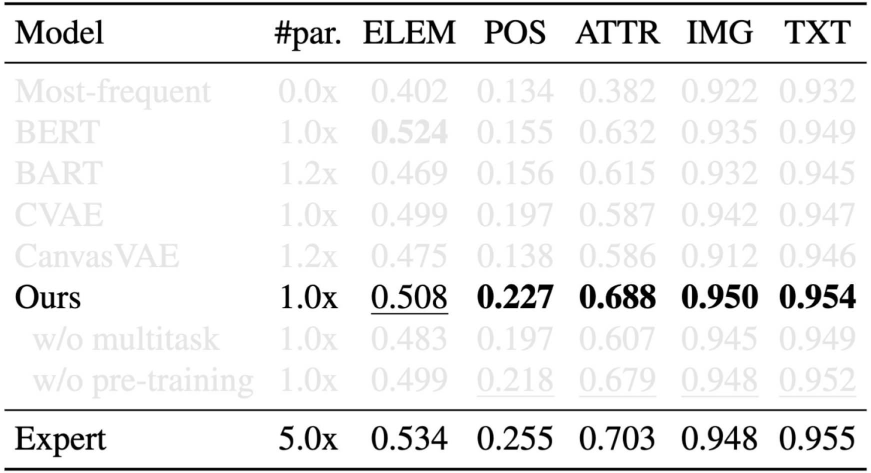

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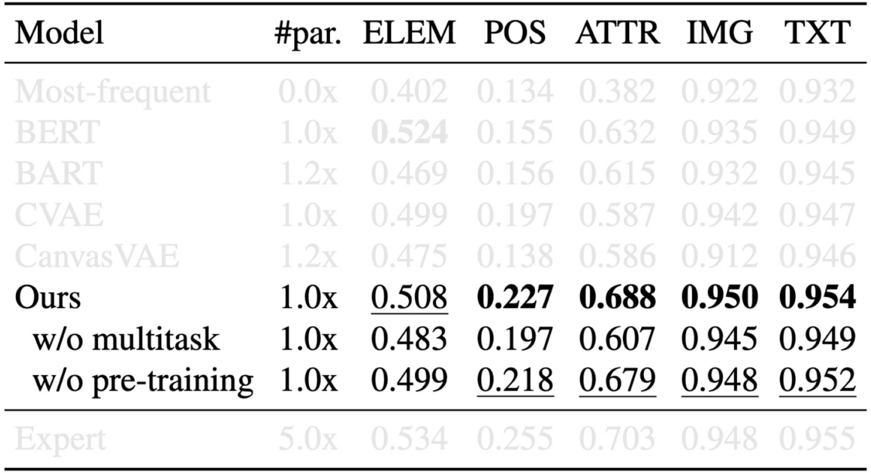

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Summary

- Masked field prediction (MFP) as a unified interface
- A model handling larger number of fields and tasks efficiently
- Promising performance in various documents (e.g., banner, web, …)

Check codes and more results at

https://cyberagentailab.github.io/flex-dm/