

Hypernym discovery : Recurrent Mapping Model(3)

RMM 구현 및 실험

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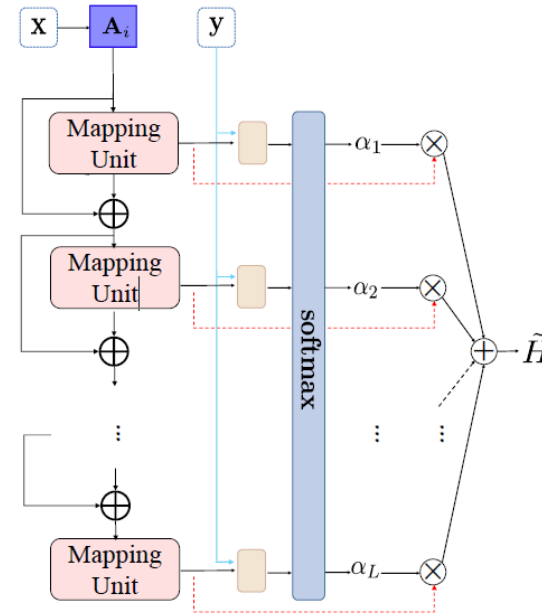
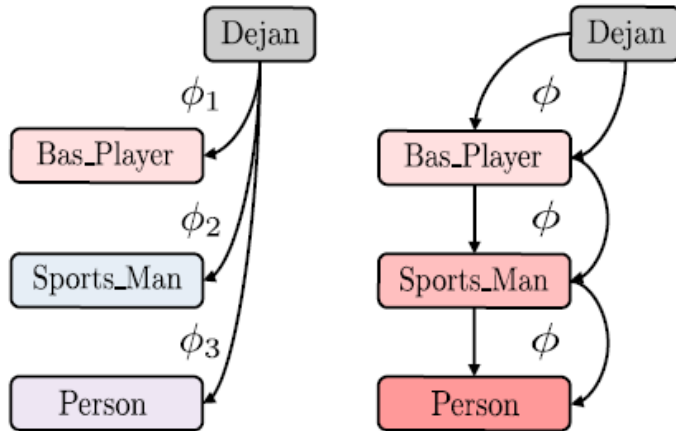
Overview

- **Recurrent Mapping Model – Hypernym discovery**
 - Loss Function
 - Issue

- **Scene Text**
 - Total Text dataset
 - Resnet50-FPN issue

Recurrent Mapping Models - Hypernym Discovery

- RMM – Recurrent Mapping Models



- ❖ $t = A_i X, t \in \mathbb{R}^{d \times 1}, A \in \mathbb{R}^{d \times d}$
- ❖ $\hat{h}_{l+1} = W_\phi h_l, h_0 = t, W_\phi \in \mathbb{R}^{d \times d}$
- ❖ $h_{l+1} = \hat{h}_{l+1} + h_l$
- ❖ $\alpha_l = \frac{\exp(h_l \cdot y)}{\sum_{k=1}^L \exp(h_k \cdot y)}$
- ❖ $\tilde{H} = \sum_{l=1}^L \alpha_l \cdot h_l$
- ❖ $s_y = \tilde{H} \cdot y$

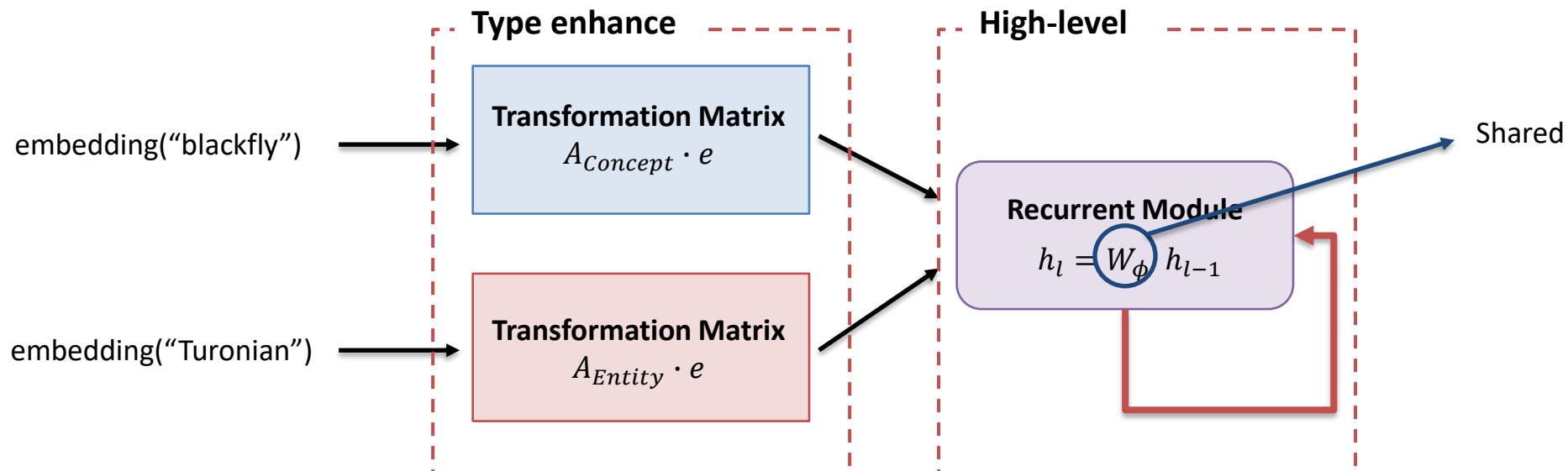
- Assume each 'is-a' relation comes from **different level**.
- Higher-level hypernym transformed from previous-level hypernym.
- X : Embedding of query.
- y : Embedding of hypernym candidate.
- A_i : Transformation matrix ($i=2$, for Concept and Entity).
- Mapping Unit : Mapping terms to higher-level hypernym using projection matrices that share other mapping units.

Recurrent Mapping Models - Hypernym Discovery

- RMM with dataset (SemEval-2018)

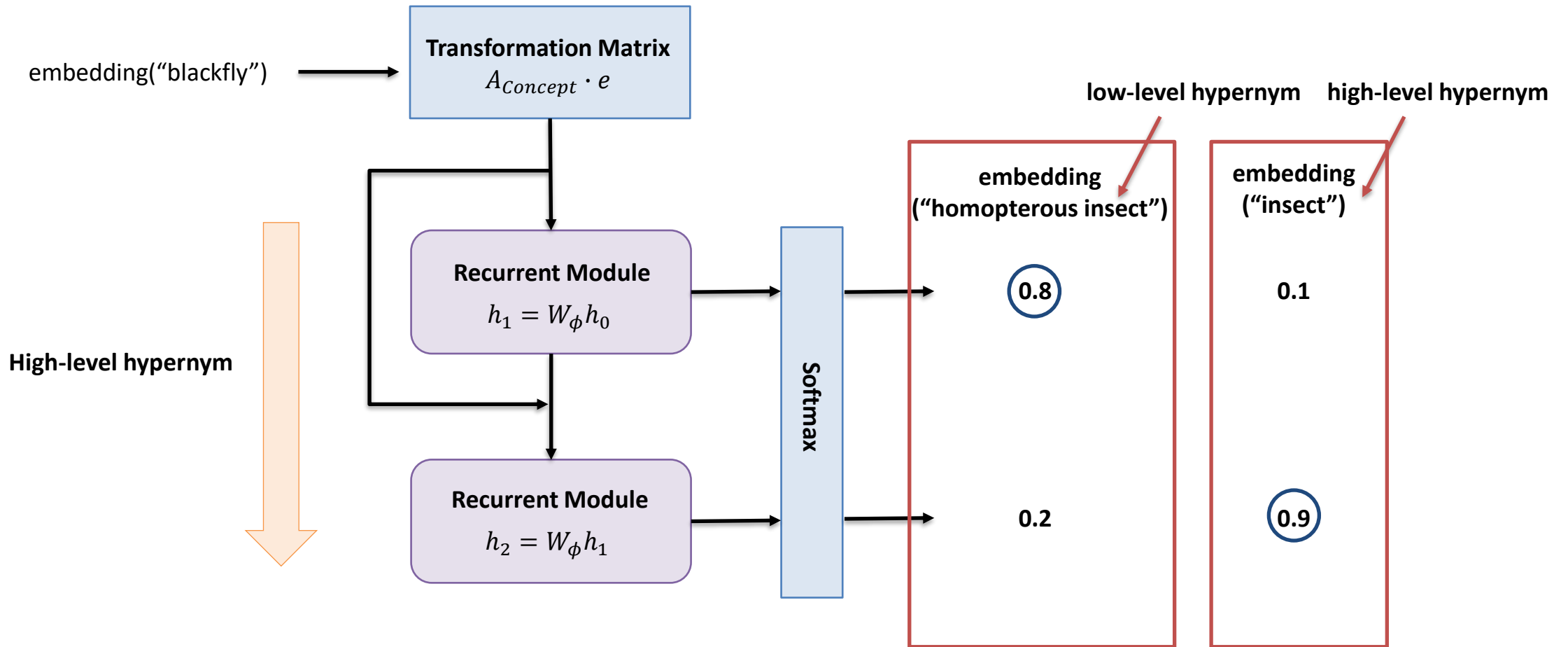
Dataset

Query hyponym(x)		Target hypernym(y)
word	type	
blackfly	Concept	homopterous insect, insect
Turonian	Entity	technical specification, geologic timescale, physical property, geological period, unit of time



Recurrent Mapping Models - Hypernym Discovery

- RMM with dataset (SemEval-2018)



Recurrent Mapping Models - Hypernym Discovery

- Loss Function

$$\diamond \mathcal{L} = - \sum_{x \in \mathcal{X}_{train}} \frac{1}{|Q_x|} \sum_{y \in Q_x} \log \frac{\exp(s_y)}{\sum_{y' \in Q_x \cup C_x} \exp(s_{y'})}$$

- x : hyponym(query), y : hypernym candidates
- Q_x : gold hypernym set of x (positive sample), C_x : negative hypernym set of x

Dataset

Query hyponym(x)		Target hypernym(y)
word	type	
blackfly	Concept	homopterous insect, insect, edit, horse, wait, ...
Turonian	Entity	technical specification, geologic timescale, physical property, geological period, unit of time, city, English, beach, ...

Recurrent Mapping Models - Hypernym Discovery

- Loss Function

$$\diamond \mathcal{L} = - \sum_{x \in \mathcal{X}_{train}} \frac{1}{|\mathcal{Q}_x|} \sum_{y \in \mathcal{Q}_x} \log \frac{\exp(s_y)}{\sum_{y' \in \mathcal{Q}_x \cup \mathcal{C}_x} \exp(s_{y'})}$$

hypernym	homopterous insect	insect	edit	horse	wait
$\frac{\exp(s_y)}{\sum_{y' \in \mathcal{Q}_x \cup \mathcal{C}_x} \exp(s_{y'})}$	0.6	0.2	0.05	0.02	0.13
log	-0.5108	-1.6094	-2.9957	-3.9120	-2.0402
$\sum_{y \in \mathcal{Q}_x}$	-2.1202				
$-\frac{1}{ \mathcal{Q}_x }$	1.0601				

Recurrent Mapping Models - Hypernym Discovery

- Loss Function

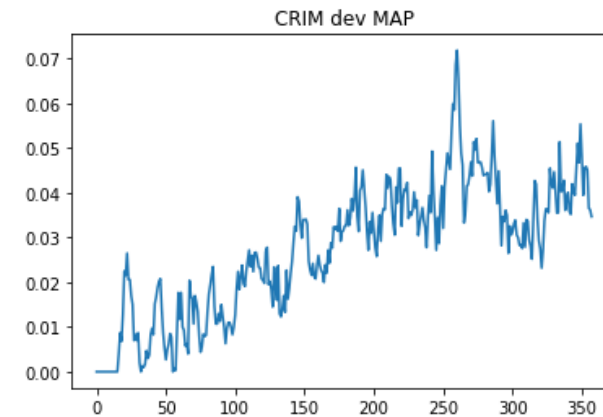
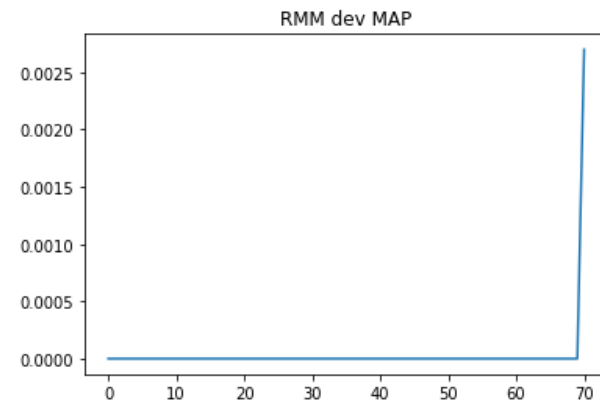
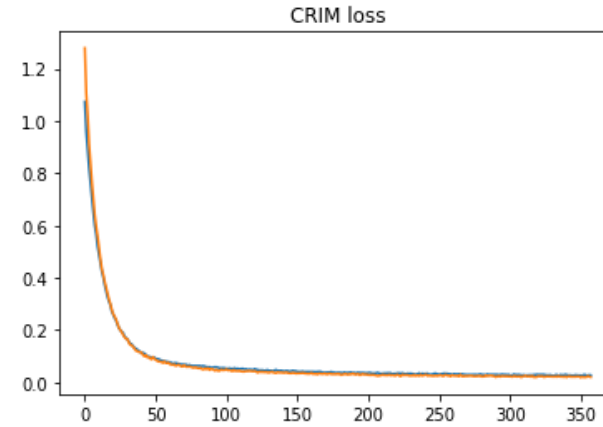
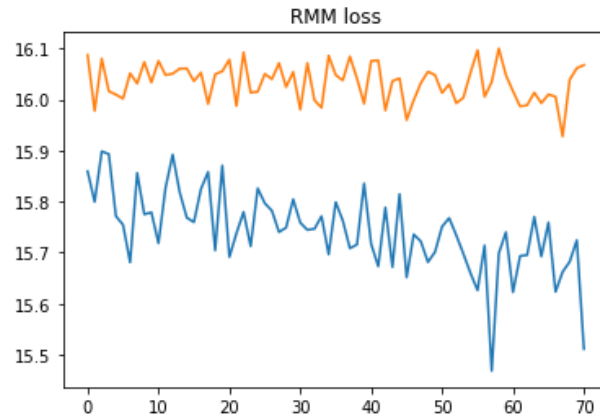
$$\diamond \mathcal{L} = - \sum_{x \in \mathcal{X}_{train}} \frac{1}{|\mathcal{Q}_x|} \sum_{y \in \mathcal{Q}_x} \log \frac{\exp(s_y)}{\sum_{y' \in \mathcal{Q}_x \cup \mathcal{C}_x} \exp(s_{y'})}$$

hypernym	homopterous insect	insect	edit	horse	wait
$\frac{\exp(s_y)}{\sum_{y' \in \mathcal{Q}_x \cup \mathcal{C}_x} \exp(s_{y'})}$	0.05	0.02	0.6	0.2	0.13
log	-2.9957	-3.9120	-0.5108	-1.6094	-2.0402
$\sum_{y \in \mathcal{Q}_x}$	-6.9077				
$-\frac{1}{ \mathcal{Q}_x }$	3.45385				

Recurrent Mapping Models - Hypernym Discovery

- Issue

- Recurrent Mapping Model isn't trained.



Recurrent Mapping Models - Hypernym Discovery

- Issue

Hyponym	Hypernym	Unsupervised	Supervised	Unsupervised - Pretrain
blackfly	homopterous insect	7.016	5.851	16.397
	insect	5.032	4.784	2.221
pollution	dirtiness	4.458	4.880	2.871
	dirtying	4.394	4.232	2.929
	environmental condition	1.795	3.715	2.150
song	possession	3.599	4.810	2.613
	sound	1.718	3.837	1.255
	work of art	2.030	3.296	2.773
	musical composition	2.544	3.609	11.249
	vocal music	3.212	4.772	10.766
	musical work	2.635	3.430	10.463
wing	emblem	2.322	3.948	1.475
	technical specification	3.529	3.430	8.673
	form	2.065	4.063	1.459
	specifications	3.644	3.682	2.682
Average		4.450	4.170	9.679

Recurrent Mapping Models - Hypernym Discovery

- Issue

- Batch size

$$\diamond \mathcal{L} = - \sum_{x \in \mathcal{X}_{train}} \frac{1}{|\mathcal{Q}_x|} \sum_{y \in \mathcal{Q}_x} \log \frac{\exp(s_y)}{\sum_{y' \in \mathcal{Q}_x \cup \mathcal{C}_x} \exp(s_{y'})}$$

- The loss was too high with **full-batch**
 - Not trained in **mini-batch**.
 - Check the input/output process of the loss function.

Future

- **Last week**

- Change batch generator for list-wise loss function
- RMM experiments with embeddings.
- CRIM experiments with embeddings.
- Other task dataset – hypernym detection (BLESS, EVAL ..)

- **Future works**

- Check loss function.
- RMM experiments with embeddings.
- CRIM experiments with embeddings.
- Other task dataset – hypernym detection (BLESS, EVAL ..)

Scene Text

- TotalText

- Images
- GT_pixel
- GT_region
- txt_format



```
x: [[214 280 362 349 284 231]], y: [[325 290 320 347 316 346]], ornt: [u'c'], transcriptions: [u'ASRAMA']
x: [[230 292 358 384 293 211]], y: [[402 430 395 419 463 425]], ornt: [u'c'], transcriptions: [u'PELAJAR']
x: [[ 53 120 121 56]], y: [[446 443 456 458]], ornt: [u'h'], transcriptions: [u'PERUNDING']
x: [[123 165 166 125]], y: [[443 440 453 455]], ornt: [u'h'], transcriptions: [u'PENILAI']
x: [[168 179 179 167]], y: [[439 439 452 453]], ornt: [u'#'], transcriptions: [u'#']
x: [[178 206 209 180]], y: [[441 438 451 454]], ornt: [u'h'], transcriptions: [u'EJEN']
x: [[ 53 148 149 51]], y: [[463 458 480 483]], ornt: [u'm'], transcriptions: [u'HENRY']
x: [[157 225 228 155]], y: [[457 452 476 479]], ornt: [u'm'], transcriptions: [u'BUTC']
x: [[ 48 141 142 53]], y: [[490 486 499 498]], ornt: [u'm'], transcriptions: [u'MALAYSIA']
x: [[151 185 185 154]], y: [[486 484 495 496]], ornt: [u'h'], transcriptions: [u'SEL']
x: [[196 236 237 199]], y: [[483 481 493 495]], ornt: [u'h'], transcriptions: [u'SDN']
x: [[244 283 286 246]], y: [[480 479 491 494]], ornt: [u'm'], transcriptions: [u'BHD']
```

ornt : orientation

c : curve

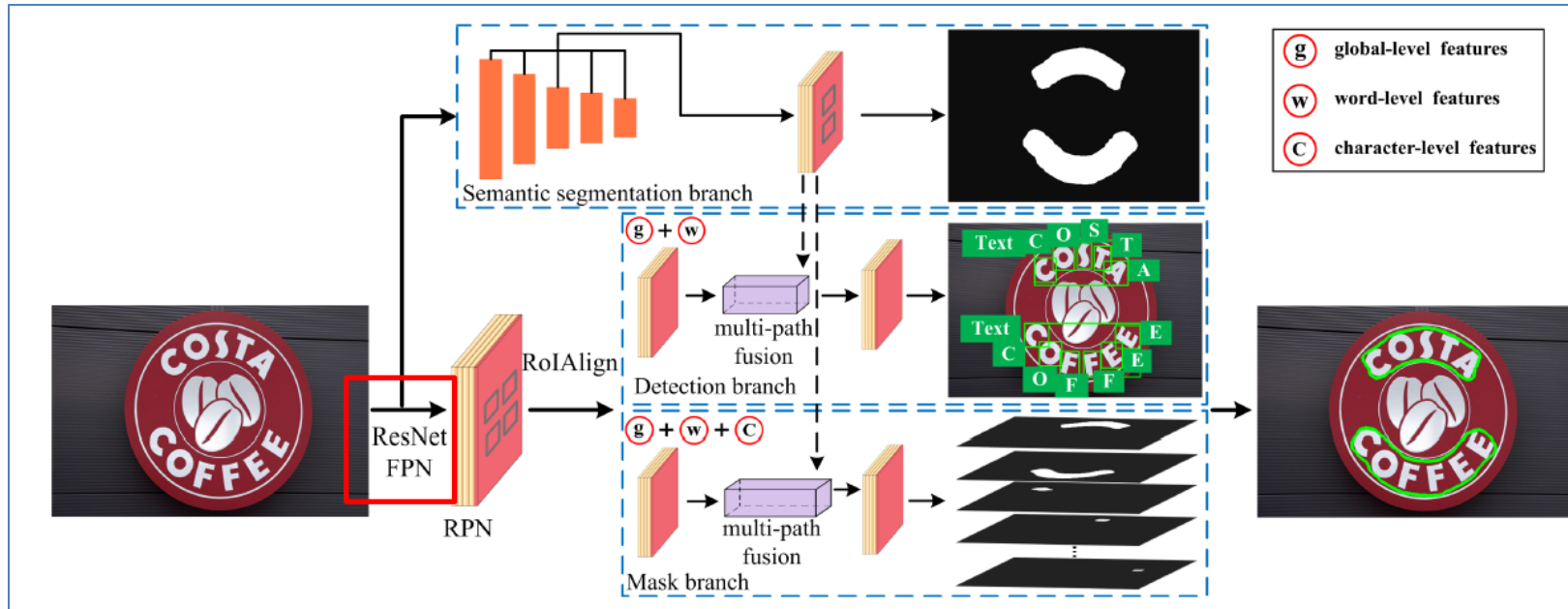
h : horizontal

m : multi-oriented

: don't care

Scene Text

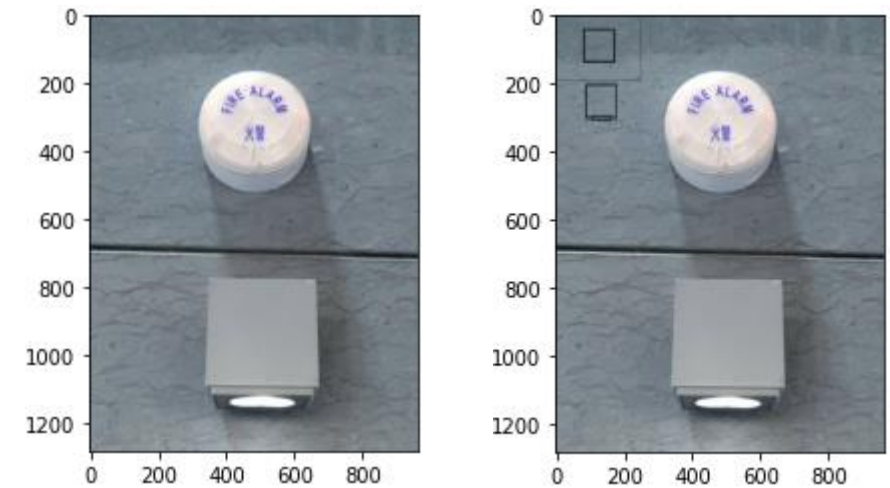
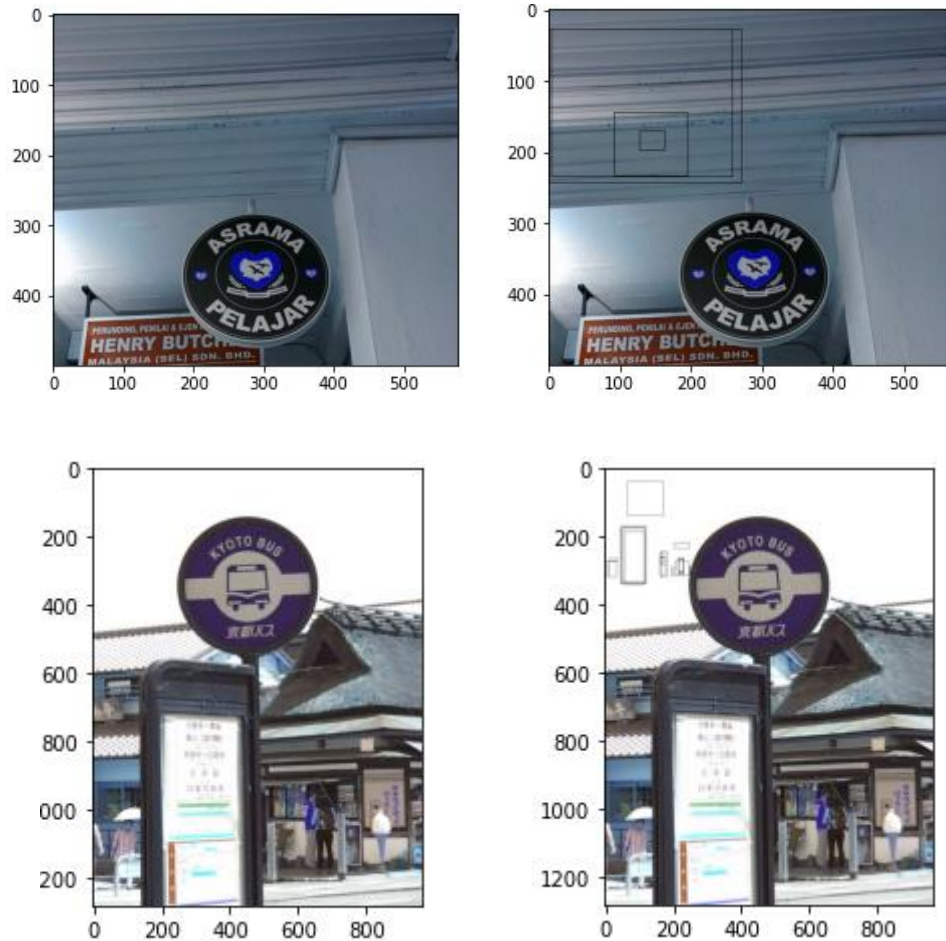
- TextFuseNet - FPN



- ResNet Feature Pyramid Networks.
- Using pre-trained models.

Scene Text

- TextFuseNet – FPN for TotalText
 - ResNet50-FPN



- For training, resize image(256).
- Output bounding box scale issue.

Thank you