山东师范大学
SHANDONG NORMAL UNIVERSITY

Logo-2K+: A Large-Scale Logo Dataset for Scalable Logo Classification

王静 闵巍庆 侯素娟 马圣南 郑元杰 王海帅 蒋树强

单　位：山东师范大学
中国科学院计算技术研究所

报告人：王 静

山东师范大学
SHANDONG NORMAL UNIVERSITY

Outline

- Introduction
- Challenge
- Dataset
- Method
- Experiments
- Conclusion

山东师范大学
SHANDONG NORMAL UNIVERSITY

Introduction

Logo Images:

Reduce costs with good visual effects and creativity

- Corporate culture
- The media of brand communication
- Carrier of intangible assets

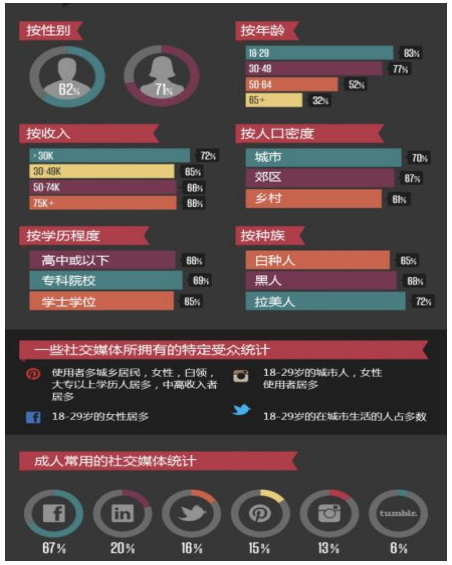
Introduction

Logo Classification：

Realize brand logo **recognition**, **accelerate** brand information **acquisition** speed to achieve publicity effect, give **consumers** efficient information **acquisition experience**.

Logo image retrieval

Copyright infringement detection



Product recommendation

山东师范大学
SHANDONG NORMAL UNIVERSITY

Challenge

(1) Datasets:

Lack of a large quality logo dataset, lower generalization ability of many models.

Dataset	Logos	Images	Availability
FlickLogos-27	27	1,080	√
(Ne			
TopLogo-10 (Su, Zhu, and Gong 2017)	10	700	√
Logo-405 (Hou et al. 2017)	405	32,218	×
Logos in the wild (Andras Tüzkö and Beyerer 2018)	871	11,054	√
WebLogo-2M (Su, Gong, and Zhu 2017)	194	1,861,177	√
PL2K (Fehérvári and Appalaraju 2019)	2,000	295,814	×

(2) Logo Classification:

Real-world logo has larger variety appearance, complexity background, multi-scale regions, smaller objects and large classes.

一、构建真实的大型logo数据集；
二、仅在label信息的监督下，能够定位关键区域解决以上logo图像存在的难题，实现有效的分类。

山东师范大学
SHANDONG NORMAL UNIVERSITY

Dataset

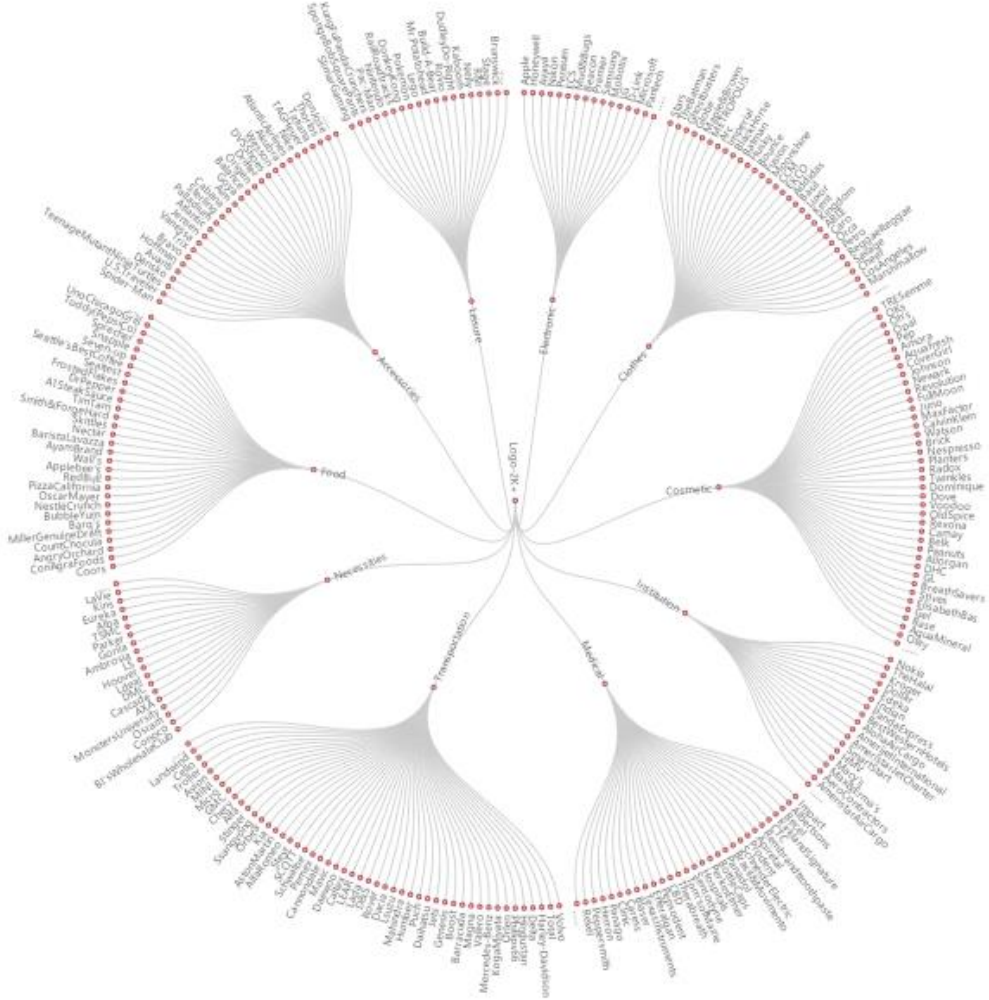
(1) Logo-2K+ Datasets:

Root Category	Logos	Images
Food	769	54,507
Clothes	286	20,413
Institution	238	17,103
Accessories	210	14,569
Transportation	203	14,719
Electronic	191	13,972
Necessities	182	13,205
Cosmetic	115	7,929
Leisure	99	7,338
Medical	48	3,385
Total	**2,341**	**167,140**

山东师范大学
SHANDONG NORMAL UNIVERSITY

Dataset

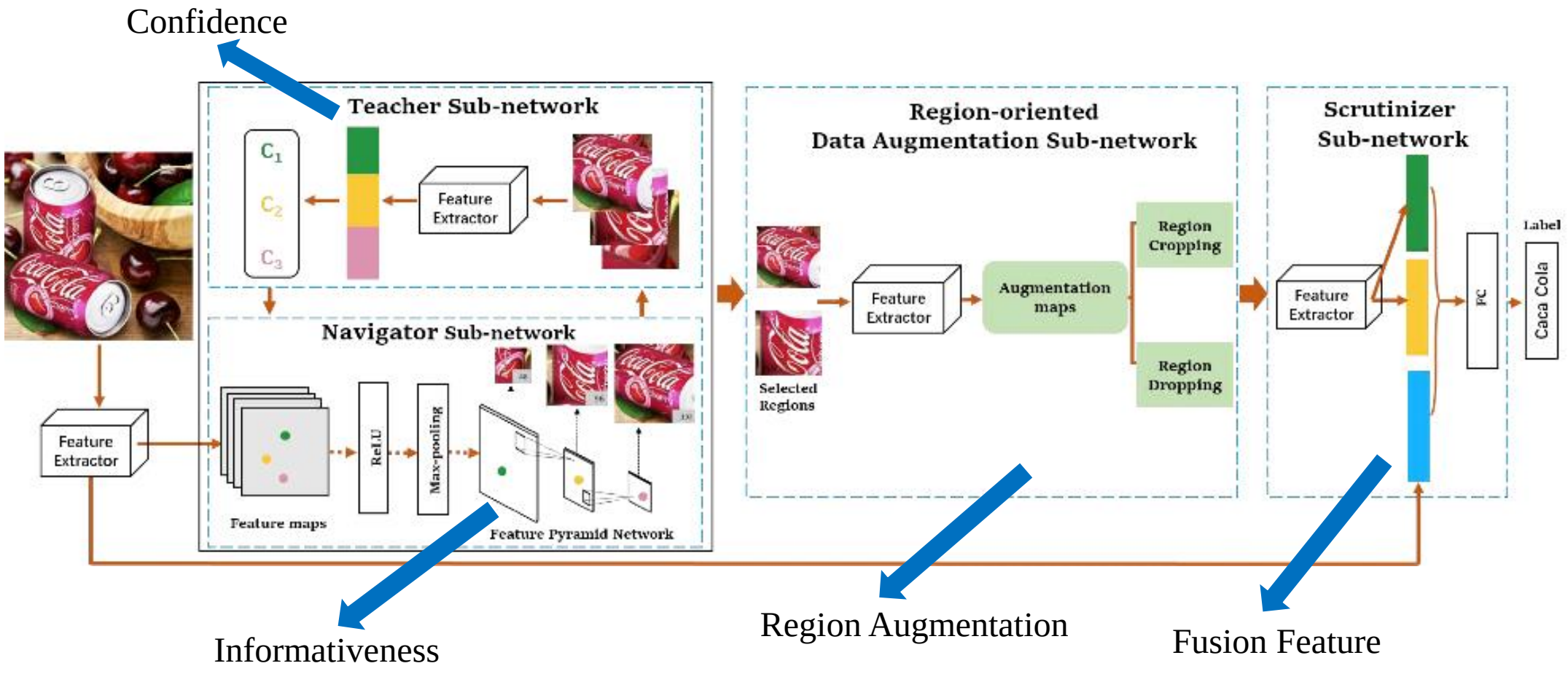
(2) Logo-2K+ Statistics:



山东师范大学
SHANDONG NORMAL UNIVERSITY

Method

Discriminative Region Navigation and Augmentation Network (DRNA-Net)



Method

Discriminative Region Navigation and Augmentation Network (DRNA-Net)

- Regions： $\mathbf{R} = \{R_1, R_2, \ldots, R_M\}$
- Informativeness： $\mathbf{I} = \{I_1, I_2, \ldots, I_M\}$
- Confidence： $\mathbf{C} = \{C(R_1), C(R_2), \ldots, C(R_M)\}$

信息量较大的区域
应该有较高置信度

- **Condition**:

  if $C(R_1) > C(R_2)$, then $I(R_1) > I(R_2)$

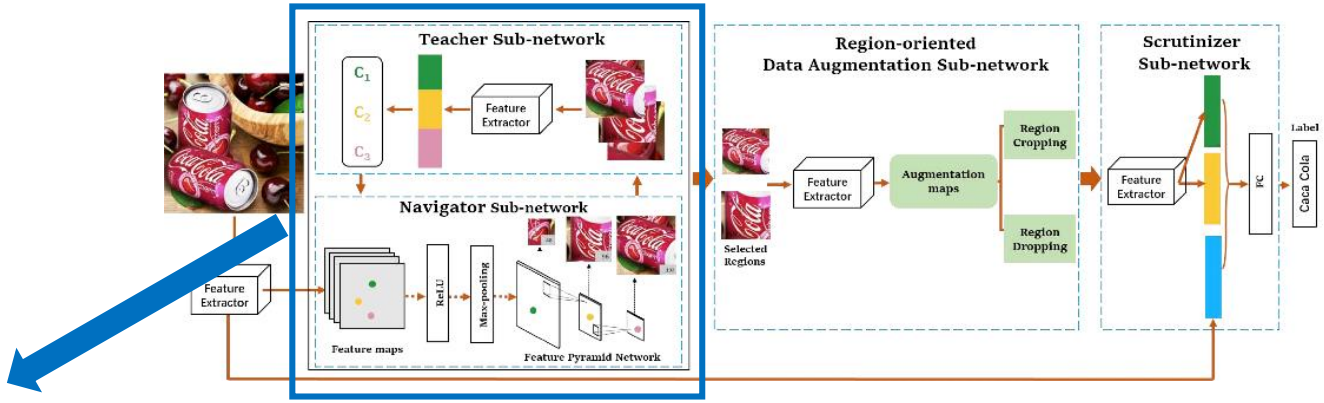
- **Ranking loss :**

$$Loss_I(I, C) = \sum_{(i,j):C_i<C_j} f(I_j - I_i)$$

山东师范大学
SHANDONG NORMAL UNIVERSITY

Method

Discriminative Region Navigation and Augmentation Network (DRNA-Net)



Navigator sub-network:

Pre-defined anchor—> FPN—>proposals —> I_i—>NMS —>Top-M region (label)

Teacher sub-network:

Top-M region —>CNN —> FC + Softmax —> region confidence

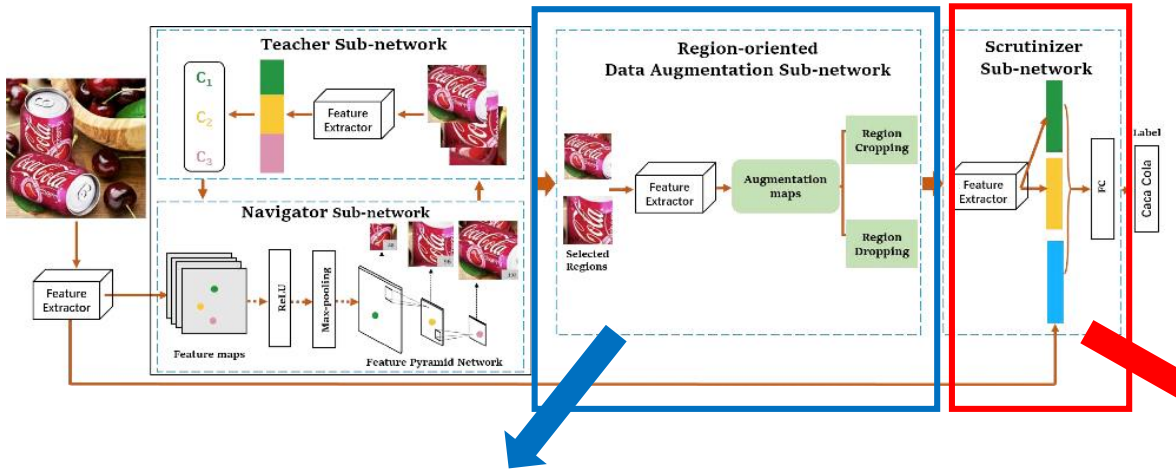
$$Loss_I(I, C) = \sum_{(i,j):C_i<C_j} f(I_j - I_i)$$

Top-K logo-relate regions

山东师范大学
SHANDONG NORMAL UNIVERSITY

Method

Discriminative Region Navigation and Augmentation Network (DRNA-Net)



Fusion the image feature and region features

Top-K regions —> Augmentation maps: $R_k^* = \frac{R_k - min(R_k)}{max(R_k) - min(R_k)}$

—> Region cropping: $C_k(i,j) = \begin{cases} 1, & if\ R_k^*(i,j) > \theta_c \\ 0, & \text{otherwise} \end{cases}$

—> Region dropping: $D_k(i,j) = \begin{cases} 0, & if\ R_k^*(i,j) > \theta_d \\ 1, & \text{otherwise} \end{cases}$

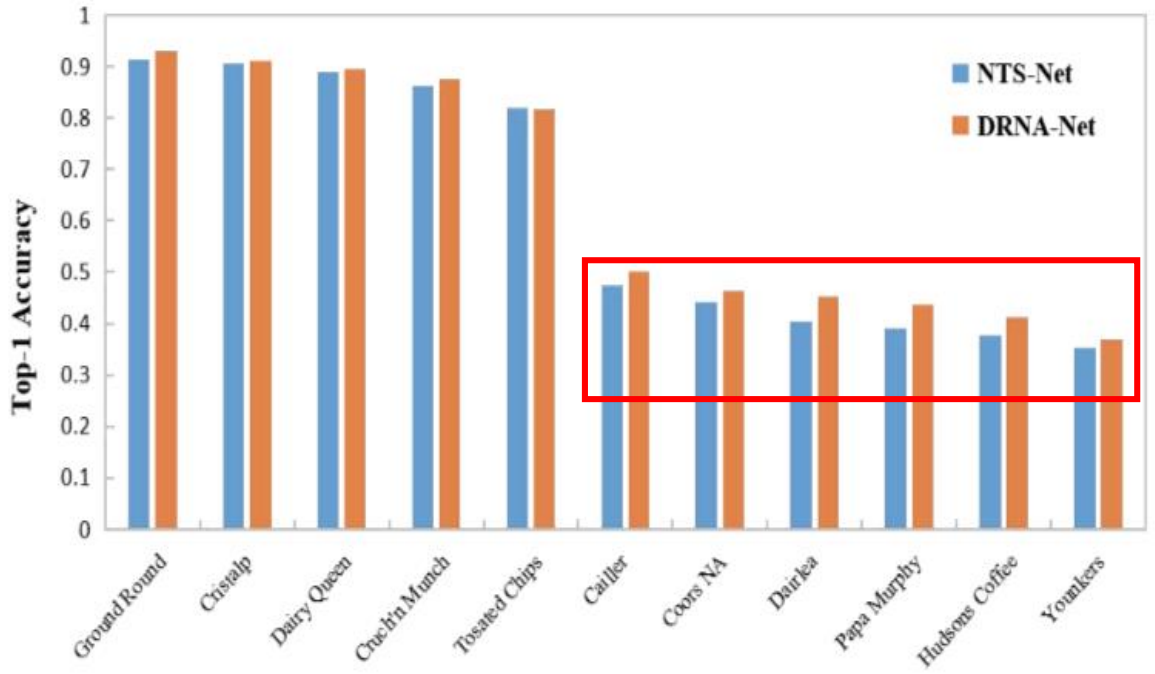
Top-K augmentation feature

山东师范大学
SHANDONG NORMAL UNIVERSITY

Experiments

Logo-2K+ dataset:

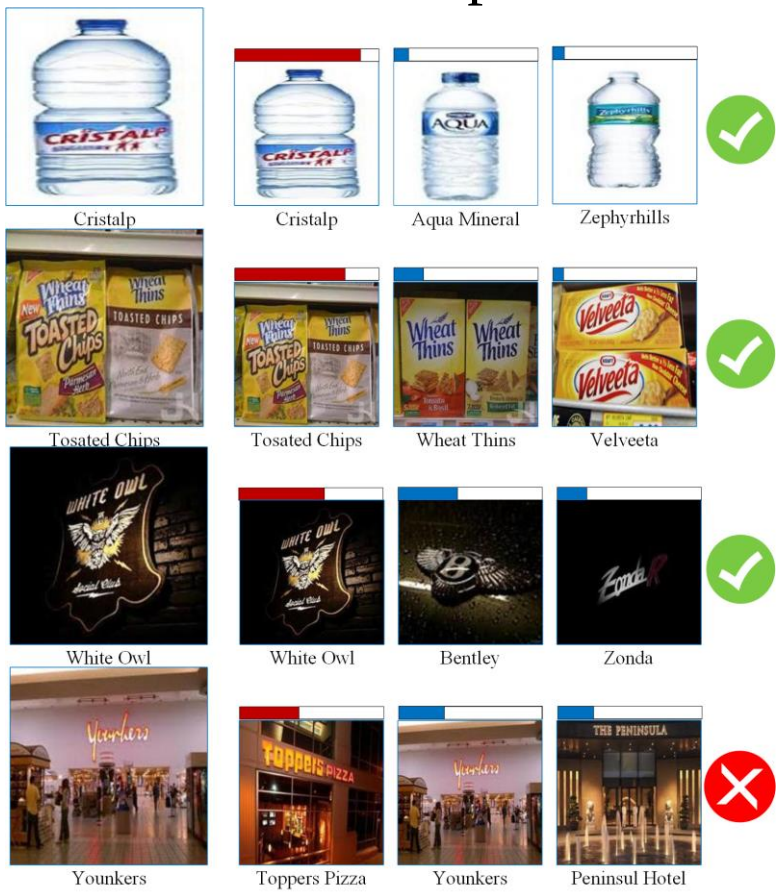
Method	Top-1 Acc.	Top-5 Acc.
AlexNet	48.80	78.45
GoogLeNet	62.36	88.33
VGGNet-16	62.83	89.01
ResNet-50	66.34	91.01
ResNet-152	67.65	91.52
VGGNet-16+Efficient+LS (He et al. 2018)	65.45	90.12
ResNet-50+Efficient+LS (He et al. 2018)	66.94	91.30
ResNet-152+Efficient+LS (He et al. 2018)	67.99	91.68
NTS-Net(ResNet-50) (Yang et al. 2018)	69.41	91.95
DRNA-Net(ResNet-50)	71.12	92.33
DRNA-Net(ResNet-152)	**72.09**	**93.45**



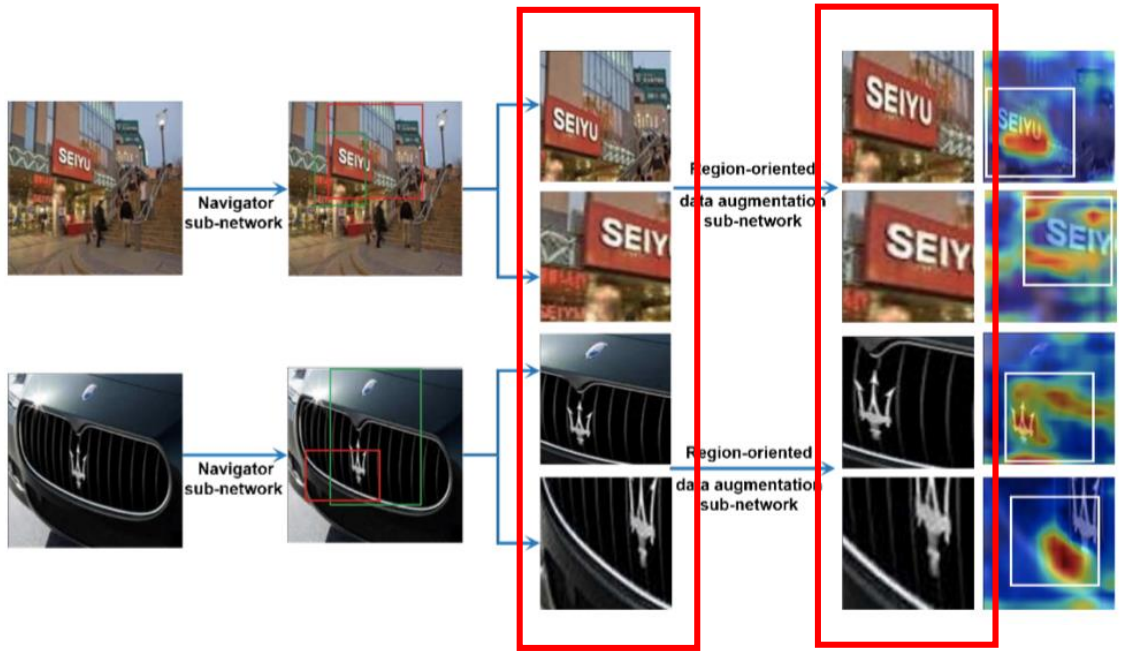
山东师范大学
SHANDONG NORMAL UNIVERSITY

Experiments

Ground-true Top-3



Visualization of Localized Regions：



山东师范大学
SHANDONG NORMAL UNIVERSITY

Experiments

BelgaLoges：

Method	Top-1 Acc.	Top-5 Acc.
RCNN(CaffeNet) (Girshick et al. 2014)	91.80	-
FRCN(VGGNet-16) (Girshick 2015)	87.30	-
SPPnet(ZF) (K. He and Sun. 2014)	87.70	-
NTS-Net(ResNet-50) (Yang et al. 2018)	93.33	96.15
DRNA-Net(VGGNet-16)	92.41	95.96
DRNA-Net(ResNet-50)	94.44	97.11
DRNA-Net(ResNet-152)	**95.82**	**98.40**

FlickrLogos-32：

Method	Top-1 Acc.	Top-5 Acc
FRCN + AlexNet (Iandola et al. 2015)	75.00	-
(C. Eggert 2015)	84.60	-
(Bianco et al. 2015)	88.40	-
(Bianco et al. 2017)	91.70	-
SIFT (S. Romberg 2013)	94.10	-
NTS-Net(ResNet-50) (Yang et al. 2018)	94.14	96.29
DRNA-Net(ResNet-50)	95.33	97.17
DRNA-Net(ResNet-152)	**96.63**	**98.80**

WebLogo-2M：

Method	Top-1 Acc.	Top-5 Acc.
AlexNet	50.99	70.62
GoogLeNet	62.14	80.21
VGGNet-16	62.88	83.23
ResNet-50	62.93	83.32
NTS-Net(ResNet-50) (Yang et al. 2018)	63.67	84.31
DRNA-Net(ResNet-50)	**64.82**	**86.12**

山东师范大学
SHANDONG NORMAL UNIVERSITY

Conclusion

A large-scale publicly available **logo dataset Logo-2K+.** The largest publicly available high-quantity dataset for logo classification.

We propose a novel **DRNA-Net**, it can automatically **two-level coarser-to-finer localization logo-relevant** informative and fused features to predict label.

We conduct extensive evaluation **other three datasets** with different scales. The results verified the **effectiveness** of proposed method.

谢谢大家！