人工智能创新应用大赛
AI INNOVATION AND APPLICATION COMPETITION (AIAC)

首届全国人工智能创新应用大赛

AI INNOVATION AND APPLICATION COMPETITION（AIAC）

总决赛

专题赛道：飞桨开源框架前沿模型复现专题赛

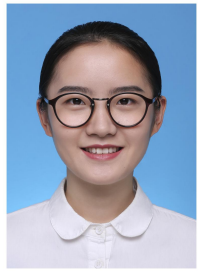
团队名：科研开小差

张佳青（队长）　西安电子科技大学

蒋恺　西安电子科技大学

张鑫　西安电子科技大学

一、介绍



张佳青，西安电子科技大学，信息与通信工程，硕士，研究高光谱目标检测

◆Xie W , **Zhang J** , Lei J , et al. **Self-spectral learning with GAN based spectral-spatial target detection for hyperspectral image**[J]. **Neural Networks, 2021(8). (学生一作，通讯作者，IF 8.05)**

第二届“天智杯”人工智能挑战赛测绘地理与气象水文数据智能化处理应用领域科目，基于卫星遥感资料的云智能识别，一等奖，航天系统部装备部

蒋恺，西安电子科技大学，信息与通信工程，博士，研究高光谱目标检测

◆**Jiang K** , Xie W , Li Y , et al. **Semisupervised Spectral Learning With Generative Adversarial Network for Hyperspectral Anomaly Detection**[J]. IEEE Transactions on Geoscience and Remote Sensing, 2020, 58(7):5224-5236. （**第一作者，Top期刊，IF 5.6**）

◆**Jiang K** , Xie W , Lei J , Jiang T , Li, Y . LREN: **Low-Rank Embedded Network for Sample-Free Hyperspectral Anomaly Detection**[J]. AAAI（**第一作者，CCF A类会议**）

◆**Jiang K** , Xie W , Lei J , Li Y , et al. **E2E-LIADE: End-to-End Local Invariant Autoencoding Density Estimation Model for Anomaly Target Detection in Hyperspectral Image**[J]. IEEE Transactions on Cybernetics, doi: 10.1109/TCYB.2021.3079247. （**第一作者，Top期刊，IF 11.448**）

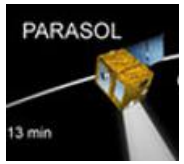
张鑫，西安电子科技大学，信息与通信工程，博士，研究高光谱目标检测，模型压缩

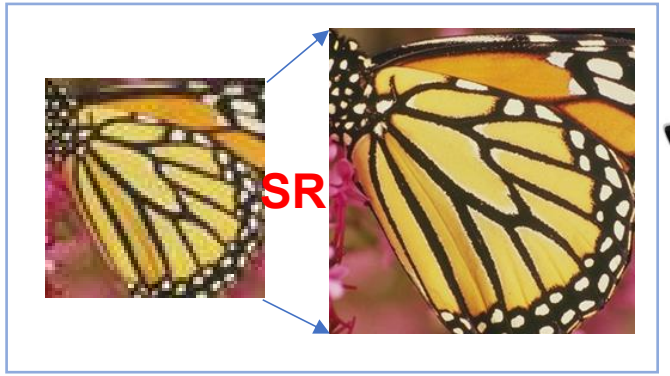
◆Xie W , **Zhang X** , Li Y , et al. **Background Learning Based on Target Suppression Constraint for Hyperspectral Target Detection**[J]. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 2020, 13:1-1.**(学生一作，通讯作者，IF 3.827)**

◆Xie W , **Zhang X** , Li Y , et al. **Weakly Supervised Low-Rank Representation for Hyperspectral Anomaly Detection**[J]. IEEE Transactions on Cybernetics. **(学生一作，中科院一区，Top 期刊，IF 11.079)**

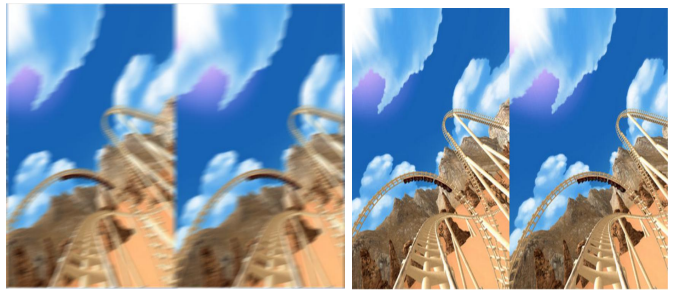
二、背景分析

remote sensing



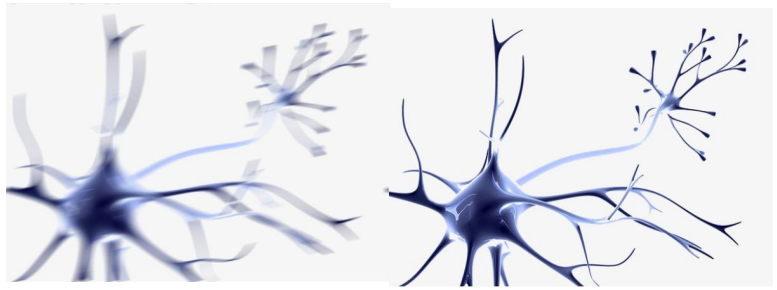


traffic monitoring



VR/AR

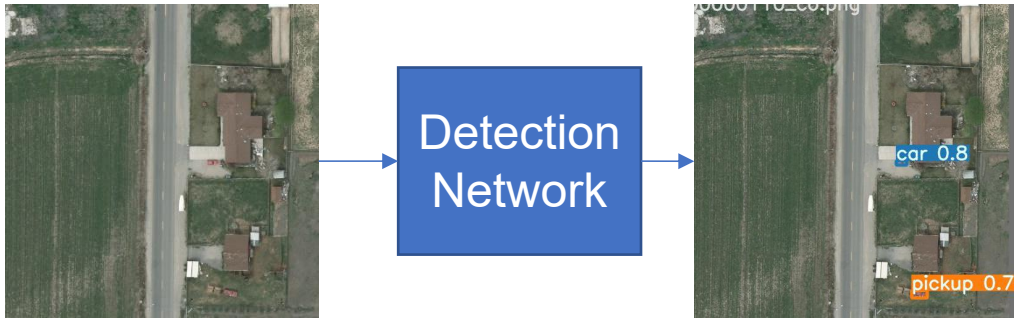
identity verification



disease diagnosis

图像超分	论文名称 ClassSR A General Framework to Accelerate Super-Resolution Networks by Data Characteristic	数据集 DIV2K	验收指标 PSNR=26.39 FLOPs=21.22G(65%) (Test2K,ClassSR-RCAN)

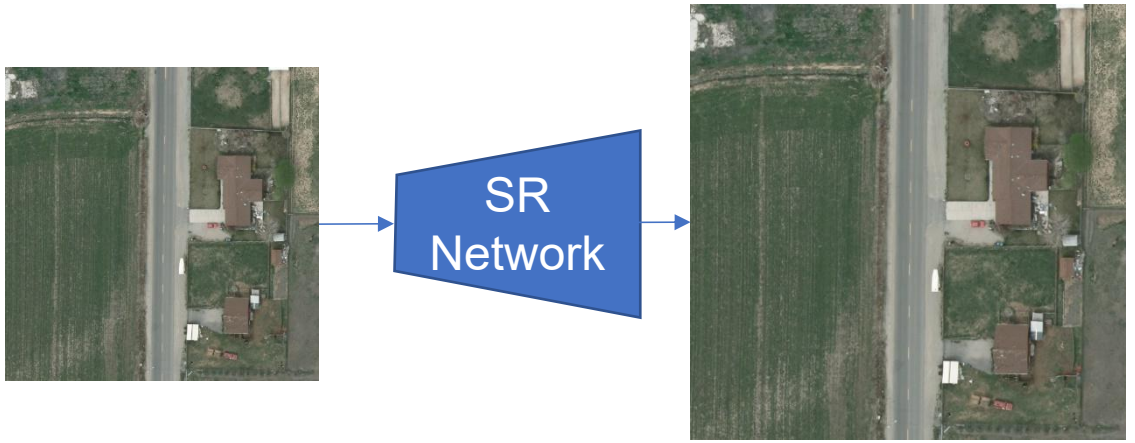
二、背景分析



特征图的分辨率会随着
网络深度的增加而下降

计算成本相对较低

	Input size	#Params	Flops
YOLOv4	320	64.4M	35.5G
YOLOv3-tiny	320	8.9M	3.3G
YOLObile	320	4.6M	4.0G

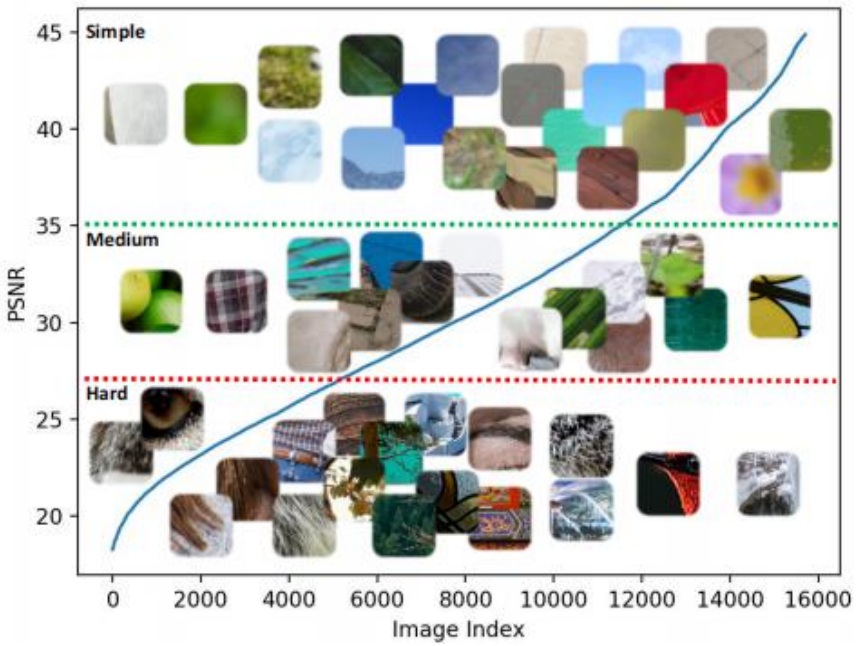


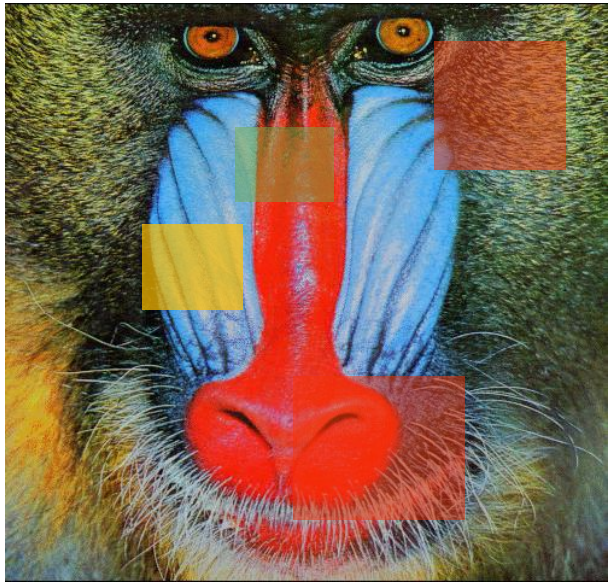
降低特侦图的分辨率会降低性能
需要在整个网络中保持完整的分辨率

计算成本很高

	Input size	#Params	Flops
VDSR	320	0.7M	272.5G
CARN	320	1.6M	99.1G
SRFBN-S	320	0.3M	255.3G

二、背景分析

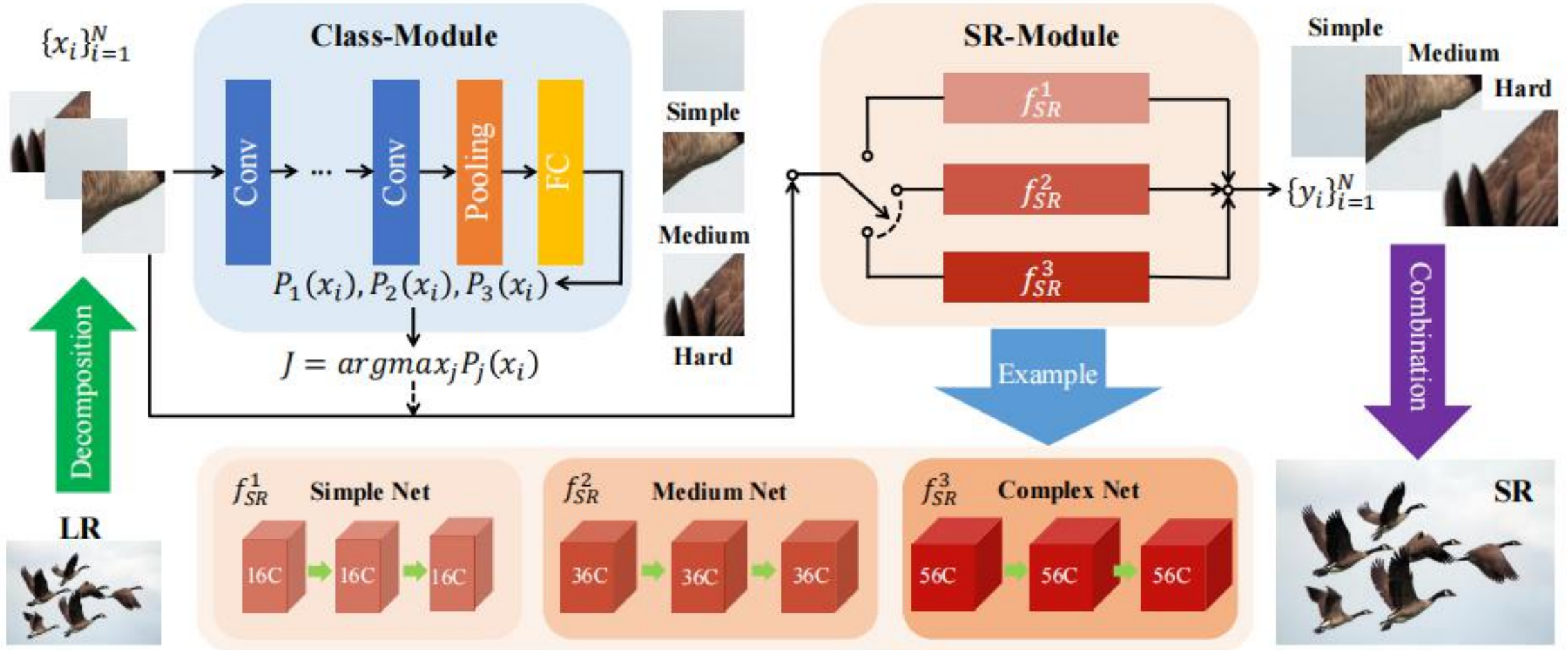




Model	FLOPs	Simple	Medium	Hard
FSRCNN (16)	141M	42.71dB	–	–
FSRCNN (36)	304M	–	29.62dB	–
FSRCNN (56)	468M	–	–	22.73dB
FSRCNN-O (56)	468M	42.70dB	29.69dB	22.71dB

Kong X, Zhao H, Qiao Y, et al, “ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic”,CVPR2021

三、实现方案

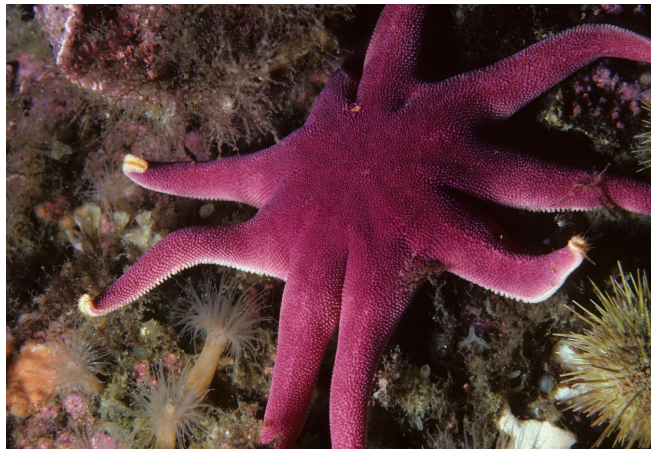


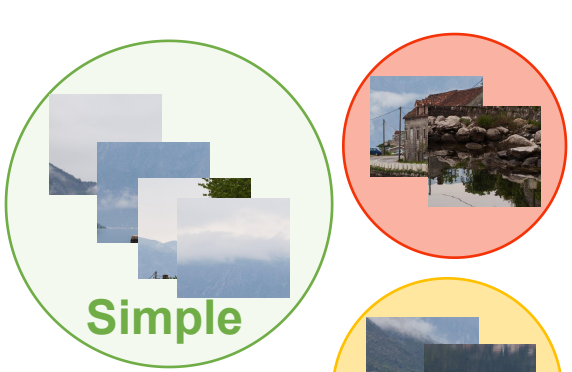
Kong X, Zhao H, Qiao Y, et al, “ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic”,CVPR2021

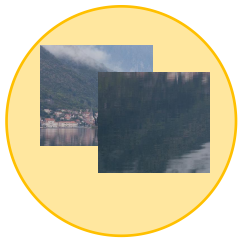
三、实现方案

以RCAN为例：切分子块

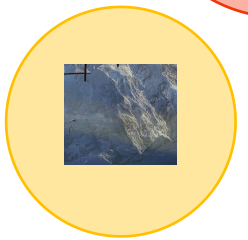
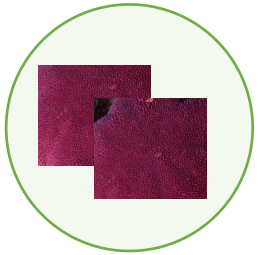
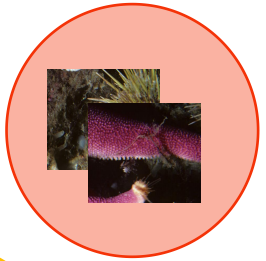




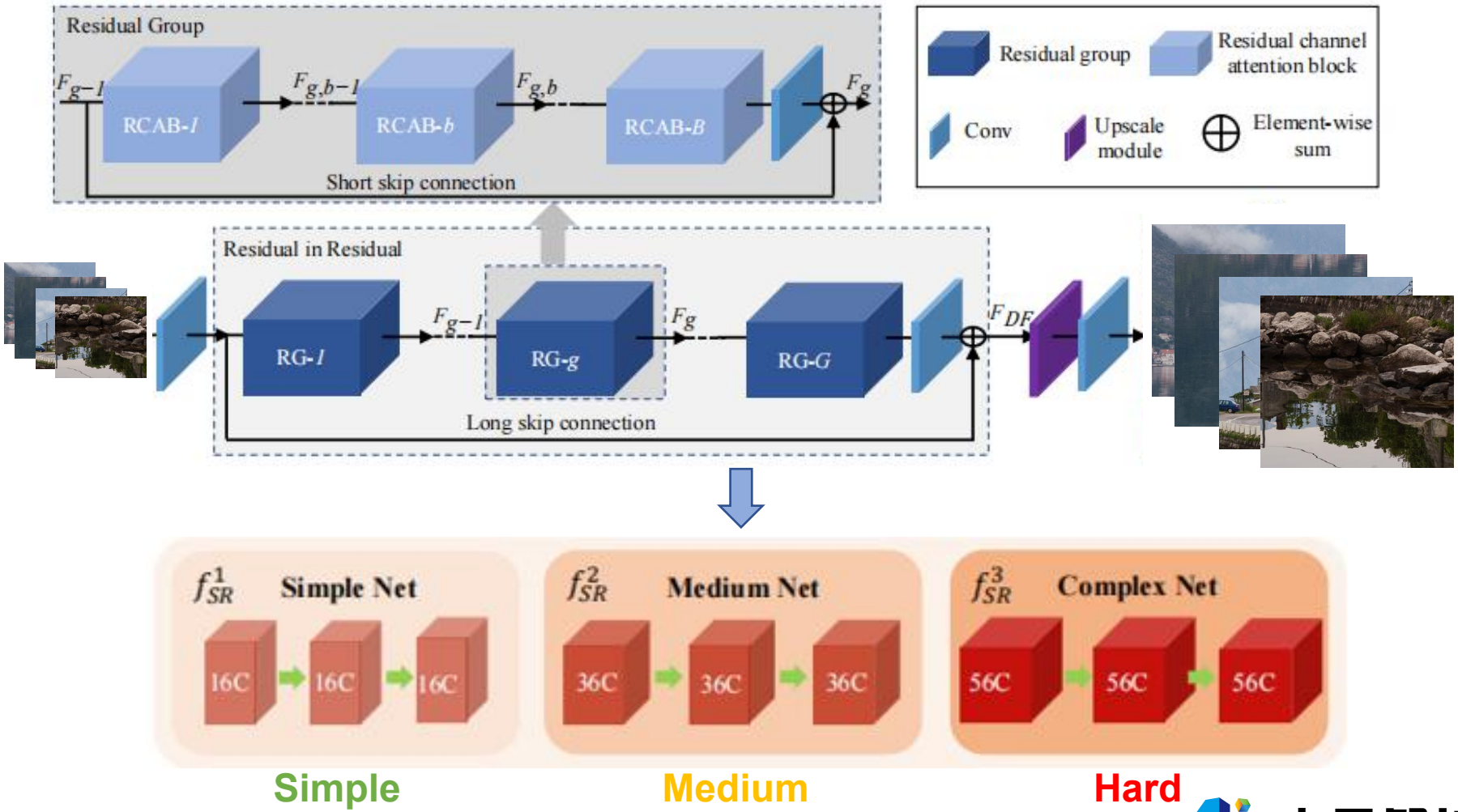





三、实现方案

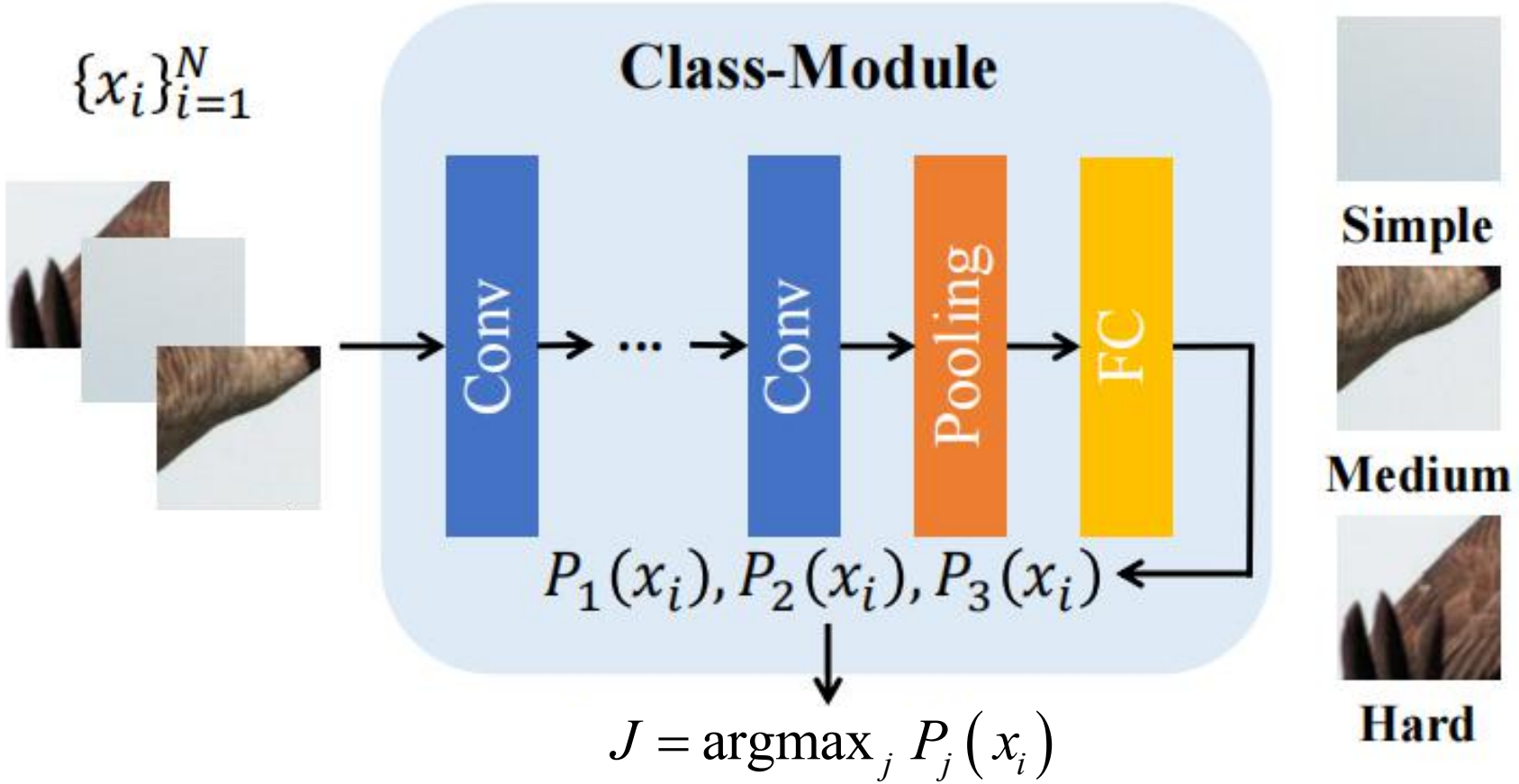
以RCAN为例：改变特征图的通道数构建不同大小的超分网络



Kong X, Zhao H, Qiao Y, et al, “ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic”,CVPR2021

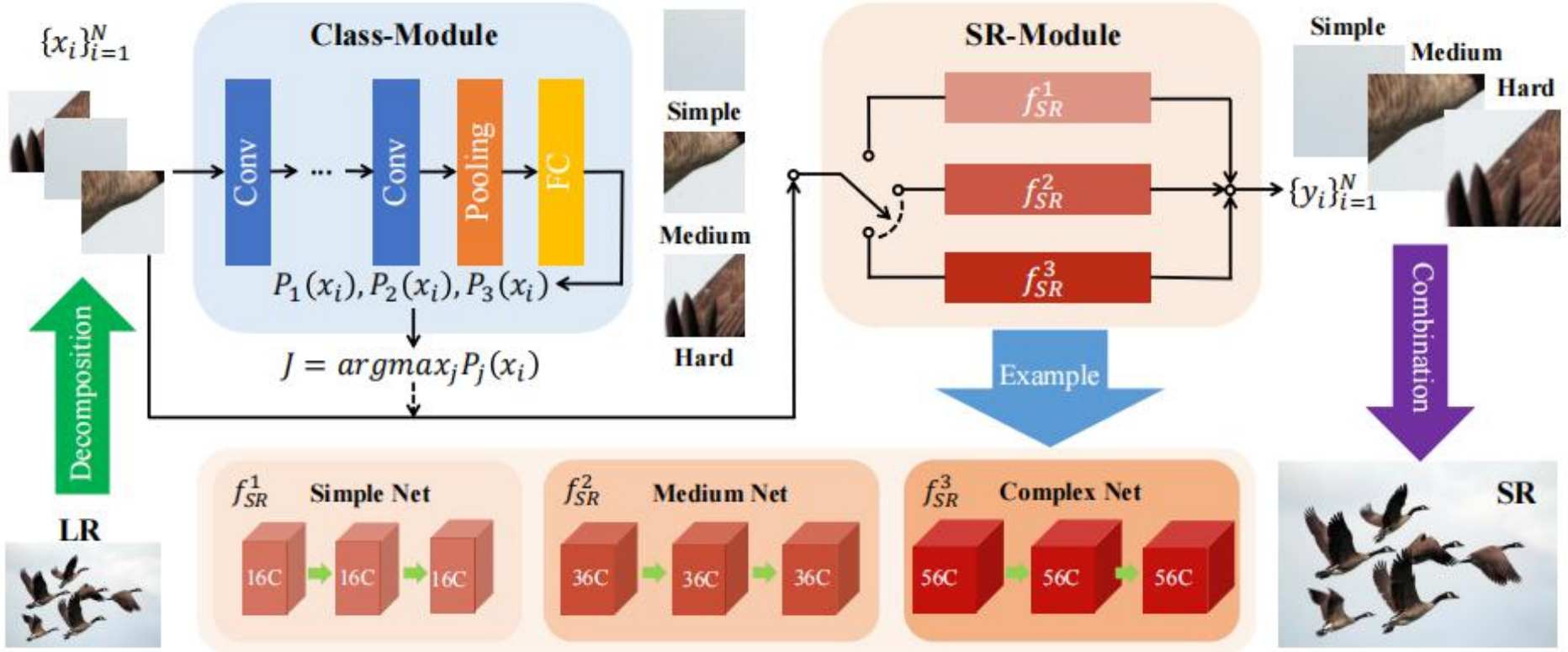
三、实现方案

以RCAN为例：构建分类器



Kong X, Zhao H, Qiao Y, et al, “ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic”,CVPR2021

三、实现方案



类损失

$$L_c = -\sum_{i=1}^{M-1}\sum_{j=i+1}^{M}\left|P_i(x) - P_j(x)\right|, s.t. \sum_{i=1}^{M} P_i(x) = 1$$

平均损失

$$L_a = \sum_{i=1}^{M}\left|\sum_{j=1}^{B} P_i\left(x_j\right) - \frac{B}{M}\right|$$

重建损失

$$L_1(x, y) = \sum_{i=0}^{N}\left|y_i - x_i\right|$$

Kong X, Zhao H, Qiao Y, et al, “ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic”,CVPR2021

四、赛题成果

RCAN-branch1

-	Model	Iteration	Test5
原论文	RCAN	-	30.275dB
复现	RCAN	52.5w	30.281dB

RCAN-branch2

-	Model	Iteration	Test5
原论文	RCAN	-	30.593dB
复现	RCAN	99w	30.492dB

RCAN-branch3

-	Model	Iteration	Test5
原论文	RCAN	-	30.430dB
复现	RCAN	98w	30.178dB

图像分割	论文名称	数据集	验收指标
	ClassSR A General Framework to Accelerate Super-Resolution Networks by Data Characteristic	DIV2K	PSNR=26.39 FLOPs=21.22G(65%) (Test2K,ClassSR-RCAN)

https://github.com/icey-zhang/ClassSR_paddle

四、赛题成果

GT

LR

ClassSR

GT

LR

ClassSR

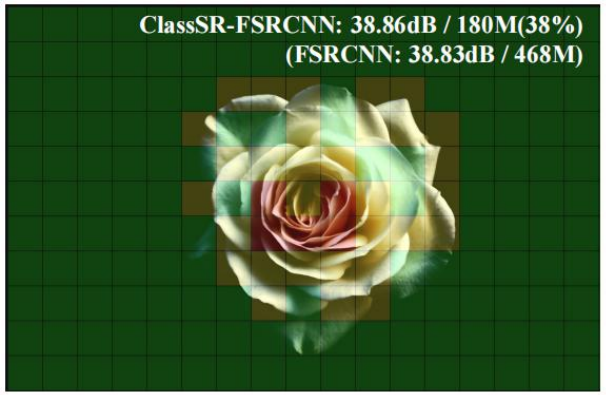
	Model	Test2K	FLOPs
原论文	ClassSR-RCAN	26.39dB	21.22G(65%)
复现	ClassSR-RCAN	26.38dB	21.36G(65.5%)

图像分割	论文名称 ClassSR A General Framework to Accelerate Super-Resolution Networks by Data Characteristic	数据集 DIV2K	验收指标 PSNR=26.39 FLOPs=21.22G(65%) (Test2K,ClassSR-RCAN)

https://github.com/icey-zhang/ClassSR_paddle

五、技术创新与工程化

计算成本的降低



DIV2K-0843 (2K)

DIV2K-0821(2K)

Test4K-1333 (4K)

超分网络的痛点：网络规模过大，需要大量计算资源，它可以在高性能服务器上取得较好的效果，但是在低功耗的边缘设备上部署困难，难以落地.

Model	Parameters	Test8K_2K	FLOPs	Test8K_4K	FLOPs	Test8K	FLOPs
FSRCNN-O	25K	28.72dB	468M(100%)	30.27dB	468M(100%)	32.66dB	468M(100%)
ClassSR-FSRCNN	113K	28.73dB	282M(60%)	30.30dB	259M(55%)	32.73dB	236M(50%)
CARN-O	295K	29.33dB	1.15G(100%)	30.88dB	1.15G(100%)	33.18dB	1.15G(100%)
ClassSR-CARN	645K	29.29dB	0.72G(63%)	30.86dB	0.67G(58%)	33.24dB	0.61G(53%)
SRResNet-O	1.5M	29.55dB	5.20G(100%)	31.13dB	5.20G(100%)	33.50dB	5.20G(100%)
ClassSR-SRResNet	3.1M	29.56dB	3.20G(62%)	31.14dB	2.95G(57%)	33.50dB	2.70G(52%)
RCAN-O	15.6M	29.83dB	32.60G(100%)	31.41dB	32.60G(100%)	33.76dB	32.60G(100%)
ClassSR-RCAN	30.1M	29.80dB	18.98G(58%)	31.40dB	17.46G(54%)	33.73dB	16.19G(50%)

Kong X, Zhao H, Qiao Y, et al, “ClassSR: A General Framework to Accelerate Super-Resolution Networks by Data Characteristic”,CVPR2021

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总决赛

主办单位：中国信息通信研究院　中国人工智能产业发展联盟

深圳赛区及总决赛联合主办单位：深圳市工业和信息化局　深圳市龙华区人民政府

深圳赛区及总决赛联合协办单位：深圳市智慧城市科技发展集团有限公司

支持单位：中国互联网协会

专题赛道承办单位：

HUAWEI　Baidu 百度　元戎启行 DEEPROUTE.AI　乐聚机器人 LEJU ROBOT　4Paradigm 第四范式　中国移动 China Mobile

China unicom 中国联通　BAOSTEEL 宝钢股份　SOUTHIS 南方数码　国家电网 STATE GRID　NARI

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