



# Vision Meets Drones: A Challenge

Pengfei Zhu Longyin Wen Dawei Du Heng Fan

Haibin Ling Qinghua Hu Mubarak Shah



# Outline

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- Application of Drones
- A Review of VisDrone 2020 Challenge
- Keynote
- Winner Announcement



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- **Application of Drones**
- A Review of VisDrone 2020 Challenge
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# Applications of Drones

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# Applications of Drones

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**ICCV 2019**  
Seoul, Korea



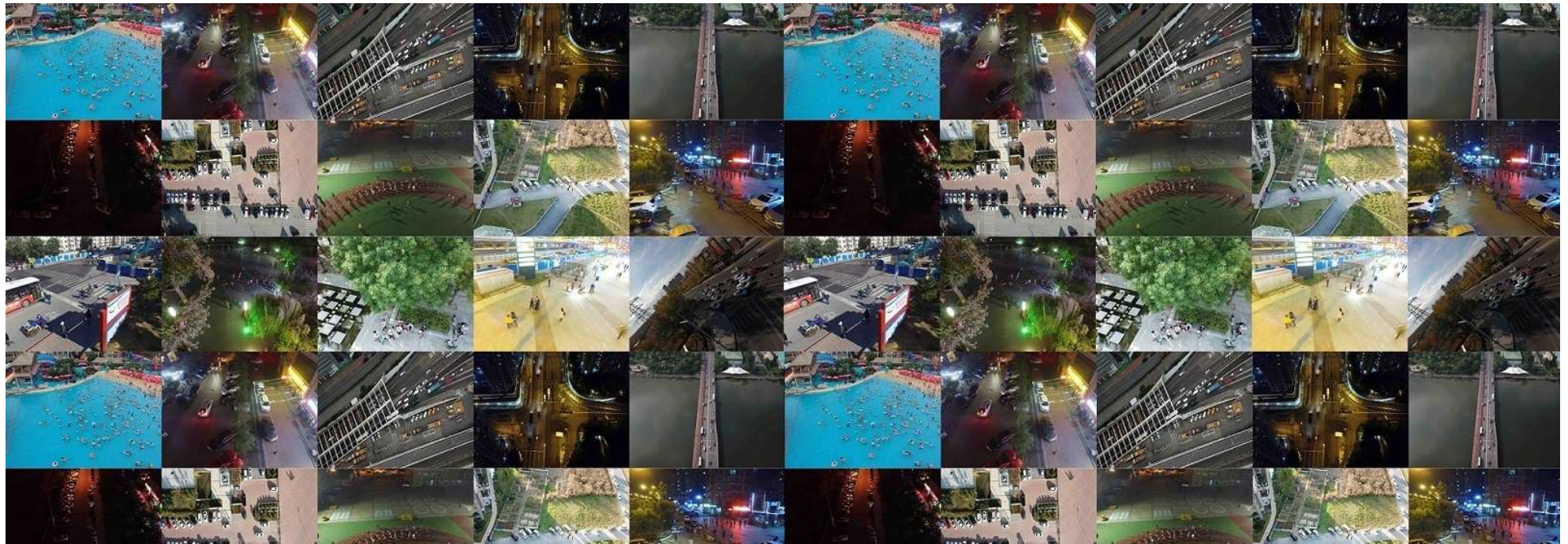
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- Application of Drones
- **A Review of VisDrone 2020 Challenge**
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# VisDrone2020



400 video clips formed by 265,228 frames and 10,209 static images

Four tasks: (1) object detection in images, (2) single-object tracking, (3) multi-object tracking, (4) crowd counting

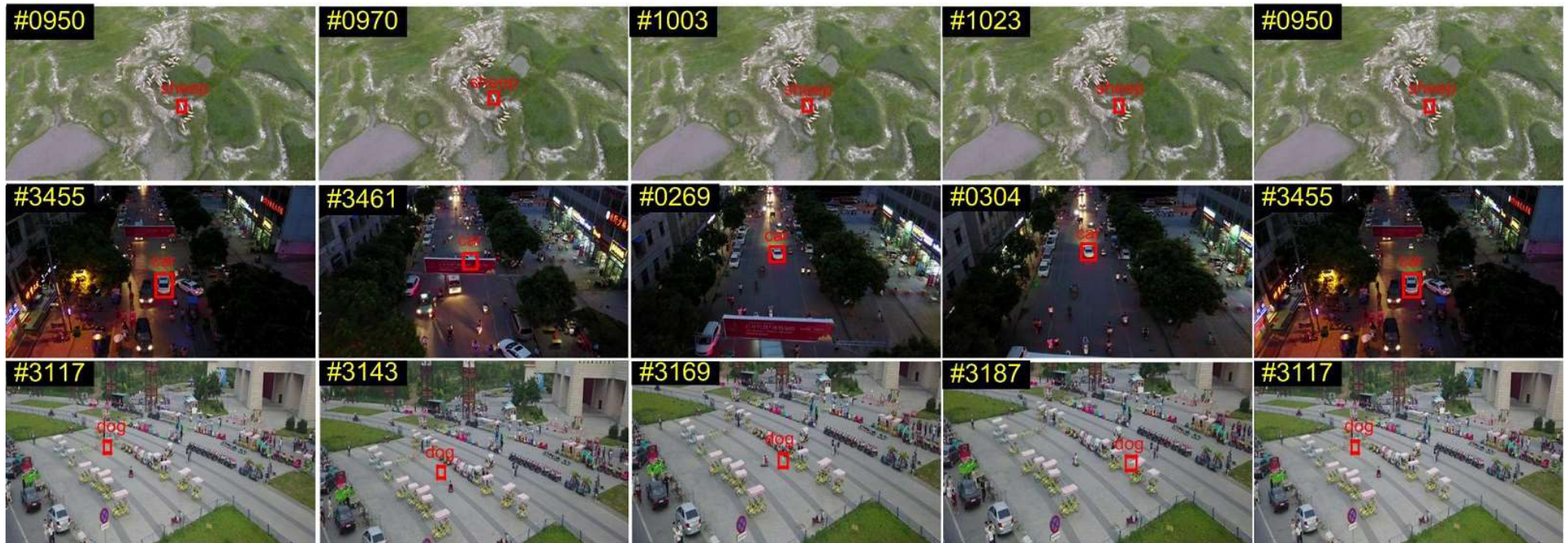
# Task 1: object detection in images



The task aims to detect objects of ten predefined categories (e.g., cars and pedestrians) from individual images taken from drones.



## Task 2: single-object tracking



The task aims to estimate the state of a target, indicated in the first frame, in the subsequent video frames.

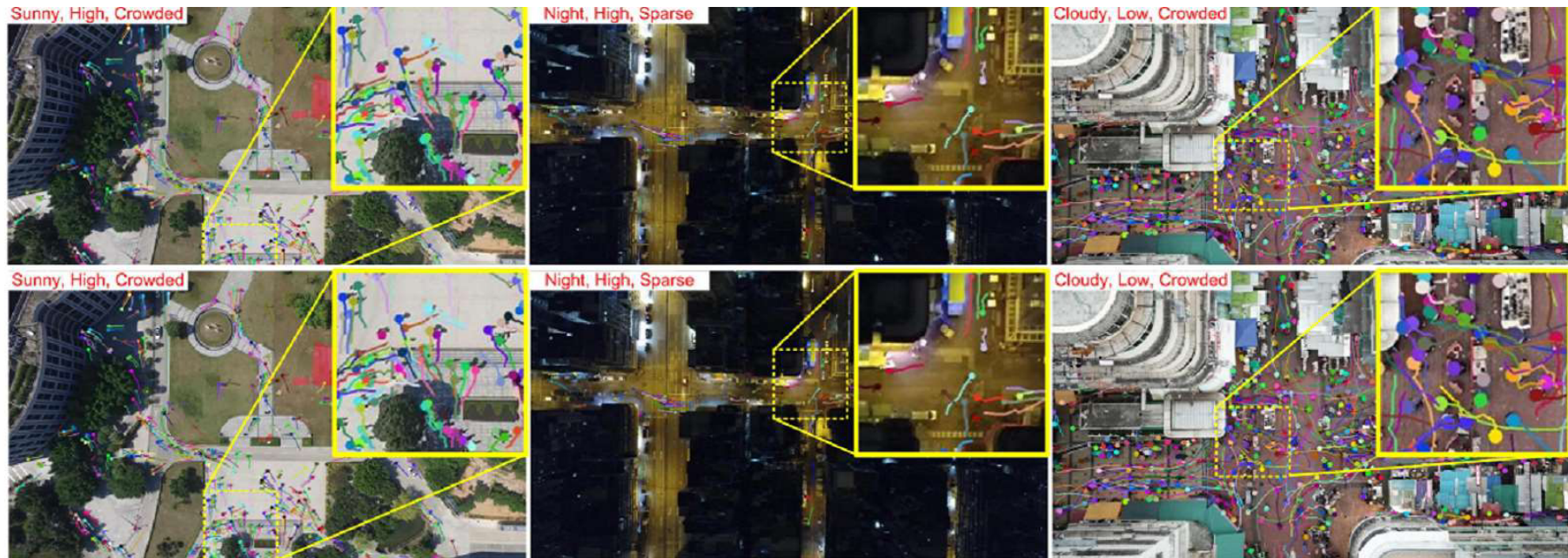
# Task 3: multi-object tracking



The task aims to recover the trajectories of five object categories in each video frame.



# Task 4: crowd counting



The task aims to estimate the number of people heads from sequential images taken from drones.

# Our workshops in three years (2018~2020)

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- Datasets: 263 videos -> 288 videos -> 400 videos
- Participation: 66 Teams -> 95 Teams -> 169 Teams
- Accepted Papers: 0 Paper -> 21 Papers -> 8 Papers

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- Application of Drones
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- Winner Announcement

# Invited Speaker

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**Prof. Jiří Matas**

Czech Technical University, Prague

# Invited Speaker

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**Jiří Matas** is currently a professor in the Faculty of Electrical Engineering at Czech Technical University (CTU), Prague. Prior to the current position, he was a Finland distinguished professor at Oulu and Tampere Universities and an associate professor at CTU, Prague. He is interested in various problems in visual recognition, tracking, image retrieval, sequential decision-making, pattern recognition, wide-baseline matching, RANSAC, face detection and recognition, biometric authentication, colour-based recognition, and Hough transform.

He is serving as an Associate Editor-in-Chief of IEEE PAMI (2009-2013), an Associate Editor of IJCV, a Programme Chair ECCV'04, ECCV'16, CVPR'07, and a General Chair CVPR'22. He organized the Visual Object Tracking (VOT) Challenge from 2013 to 2020.



# **Invited Keynote**

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## **UAVs and Vision - Challenges encountered in Competitions and Application**

**Prof. Jiří Matas**

# Outline

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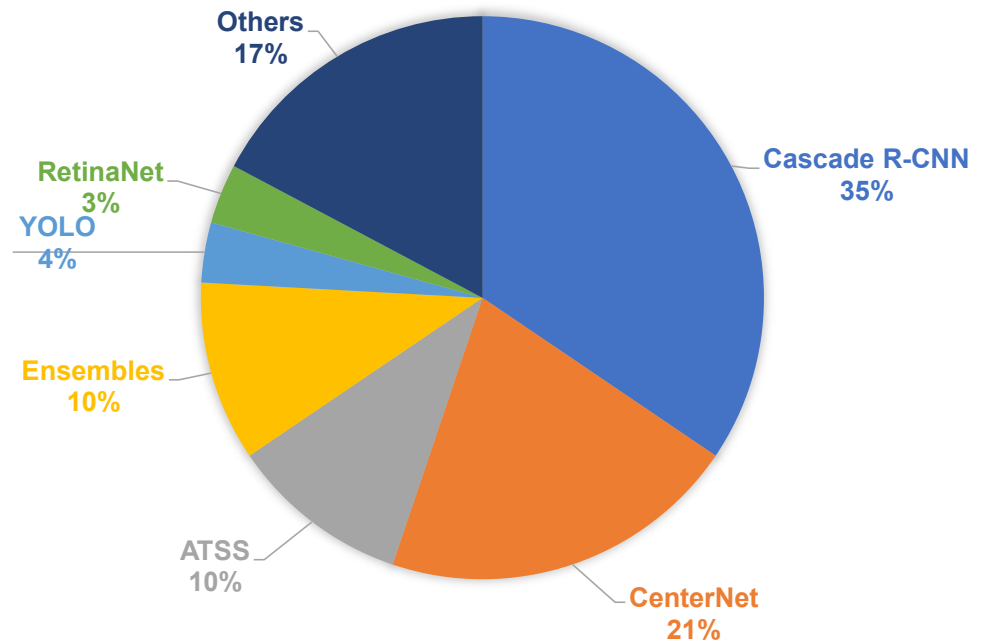
- Application of Drones
- A Review of VisDrone 2020 Challenge
- Keynote
- **Winner Announcement**

# Task 1: object detection in images

**85** Teams

**1** Winner

**3** Honorable Mention



Method	AP[%]	AP50[%]	AP75[%]	AR1[%]	AR10[%]	AR100[%]	AR500[%]
DPNetV3 (A.1)	37.37	62.05	39.10	0.85	7.96	42.03	53.78
SMPNet (A.2)	35.98	59.53	37.41	0.29	2.01	8.46	53.33
DroneEye2020 (A.3)	34.57	58.21	35.74	0.28	1.92	6.93	52.37
TAUN (A.4)	34.54	59.42	34.97	0.14	0.72	12.81	49.80



# Task 1: object detection in images

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## Winner

### Drone Pyramid Network V3 (DPNetV3)

Heqian Qiu, Zichen Song, Minjian Zhang, Mingyu Liu, Taijin Zhao, Fanman Meng, Hongliang Li  
University of Electronic Science and Technology of China, China

### Using Split, Mosaic and Paster to solve the balance problem in aerial images (SMPNet)

Chengzhen Duan, Zhiwei Wei

Harbin Institute of Technology(Shenzhen), China

## Honorable Mention

### Cascade R-CNN on Drone-captured Scenarios (DroneEye2020)

Sungtae Moon<sup>1</sup>, Joochan Lee<sup>2</sup>, Jungyeop Yoo<sup>2</sup>, Jonghwan Ko<sup>2</sup>, Yongwoo Kim<sup>3</sup>

<sup>1</sup>Korea Aerospace Research Institute, <sup>2</sup>Sungkyunkwan University, <sup>3</sup>Sangmyung University, South Korea

### Tricks are All yoU Need (TAUN)

Jingkai Zhou<sup>1</sup>, Weida Qin<sup>1</sup>, Zhongjie Fan<sup>1</sup>, Shuqin Huang<sup>1</sup>, Qiong Liu<sup>1</sup>, Ming-Hsuan Yang<sup>2</sup>

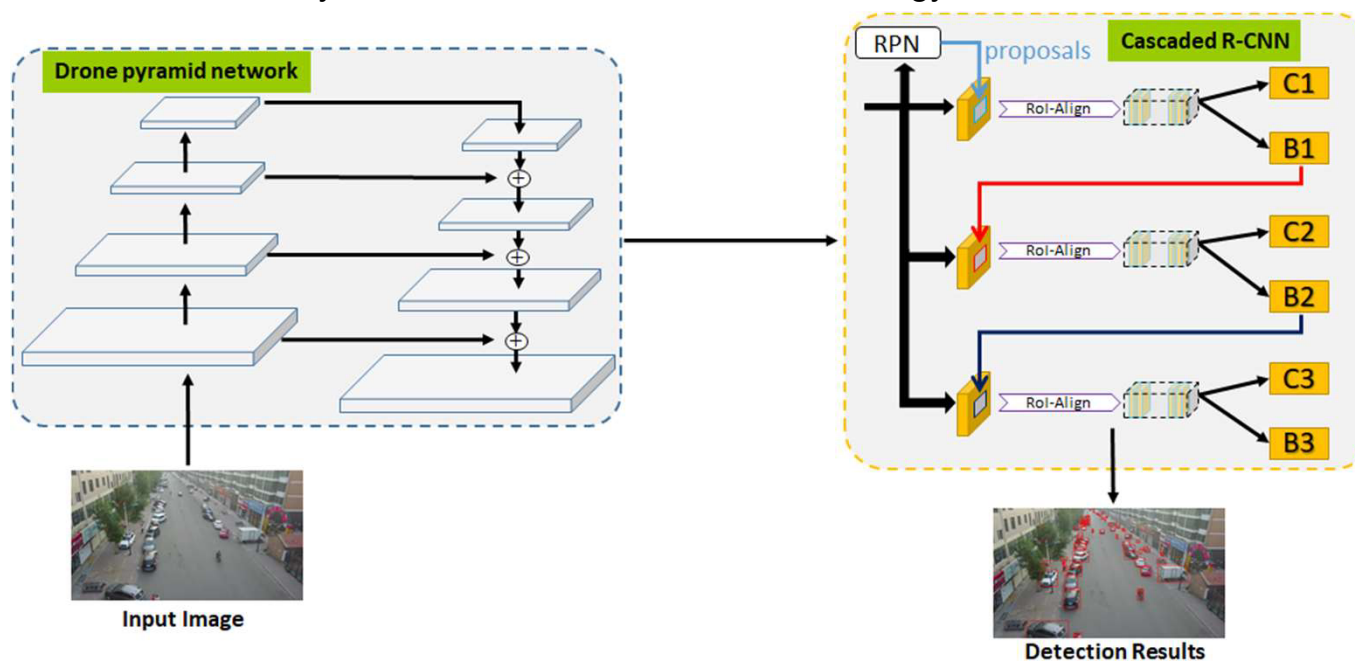
<sup>1</sup>South China University of Technology, China, <sup>2</sup>University of California at Merced, USA

# Task 1: winner talk

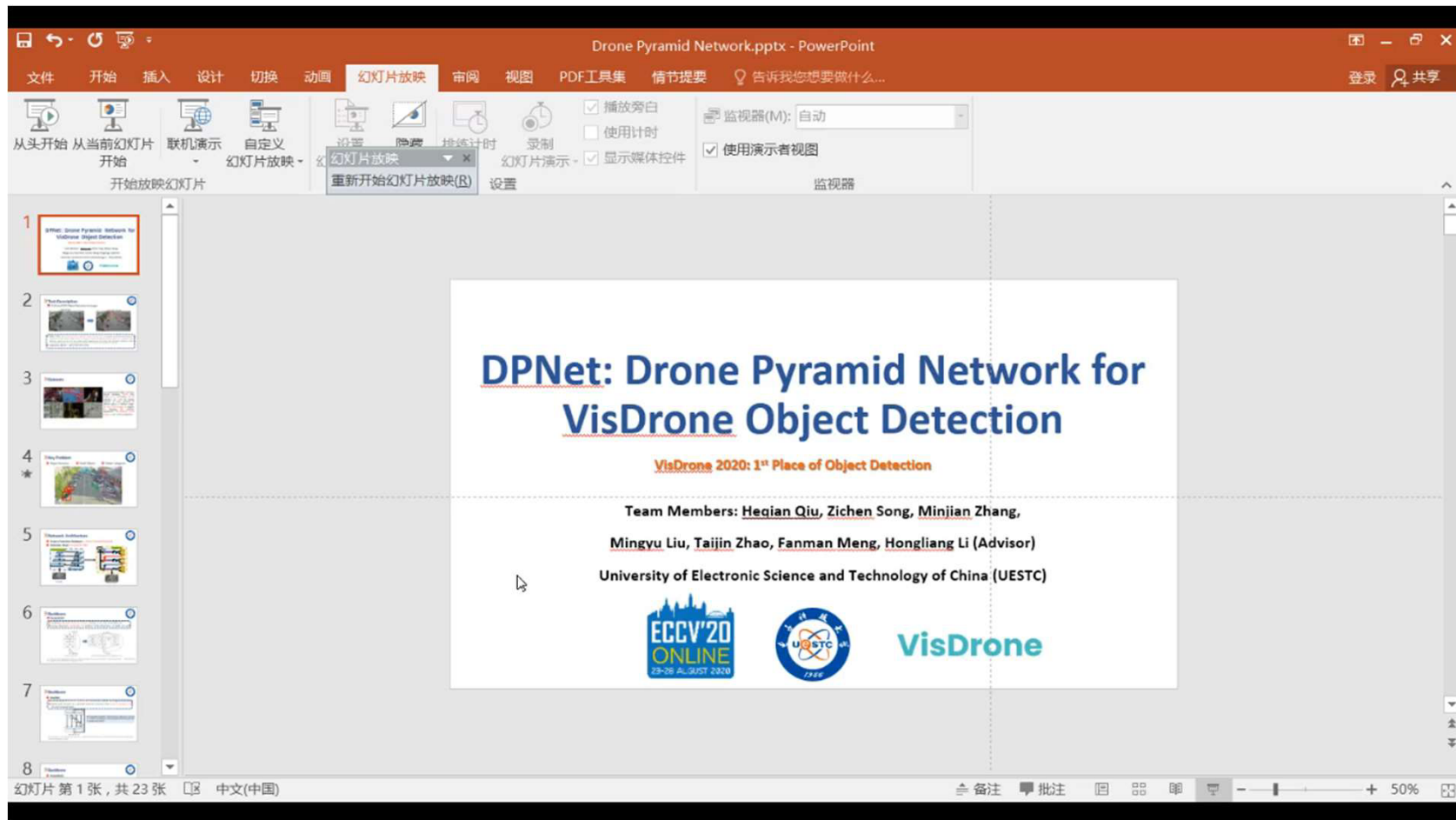
## Drone Pyramid Network V3 (DPNetV3)

Heqian Qiu, Zichen Song, Minjian Zhang, Mingyu Liu, Taijin Zhao, Fanman Meng, Hongliang Li

University of Electronic Science and Technology of China, China



# Task 1: winner talk

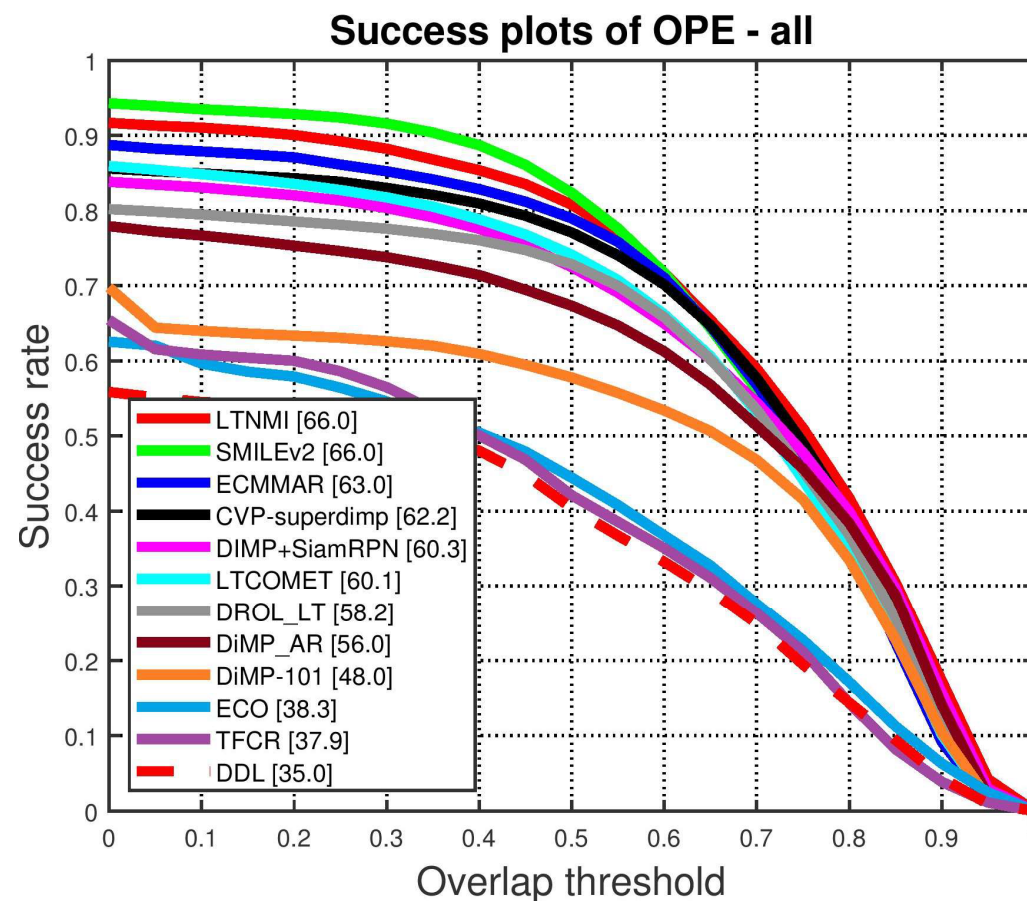
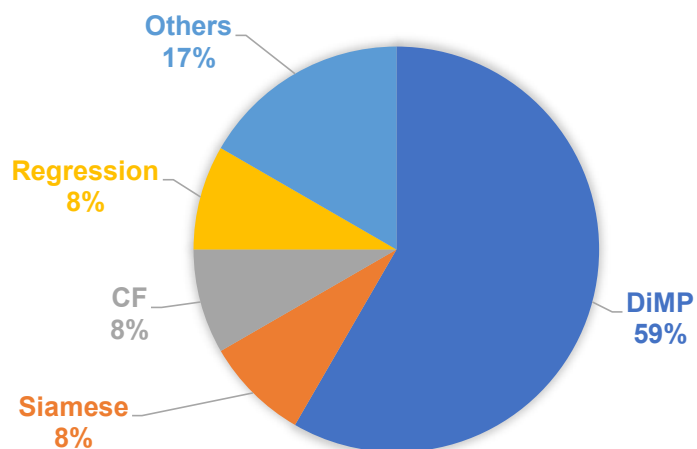


# Task 2: single object tracking

**28** Teams

**1** Winner

**2** Honorable Mention



# Task 2: single object tracking

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## Winner

Strategy and motion integrated long-term experts (SMILEv2)

Yuxuan Li<sup>1</sup>, Zhongjian Huang<sup>1</sup>, Biao Wang<sup>2</sup>

<sup>1</sup>Xidian University, <sup>2</sup>WeBank, China

## Honorable Mention

Long-term Tracking with Night-enhancement and Motion Integrated  
(LTNMI)

Yuting Yang<sup>1</sup>, Yanjie Gao<sup>1</sup>, Ruiyan Ma<sup>1</sup>, Xin Hou<sup>2</sup>

<sup>1</sup>Xidian University, <sup>2</sup>WeBank, China

Ensemble of Classification and Matching Models with Alpha-Refine for  
UAV Tracking (ECMMAR)

Shuhao Chen, Zezhou Wang, Simiao Lai, Dong Wang, Huchuan Lu

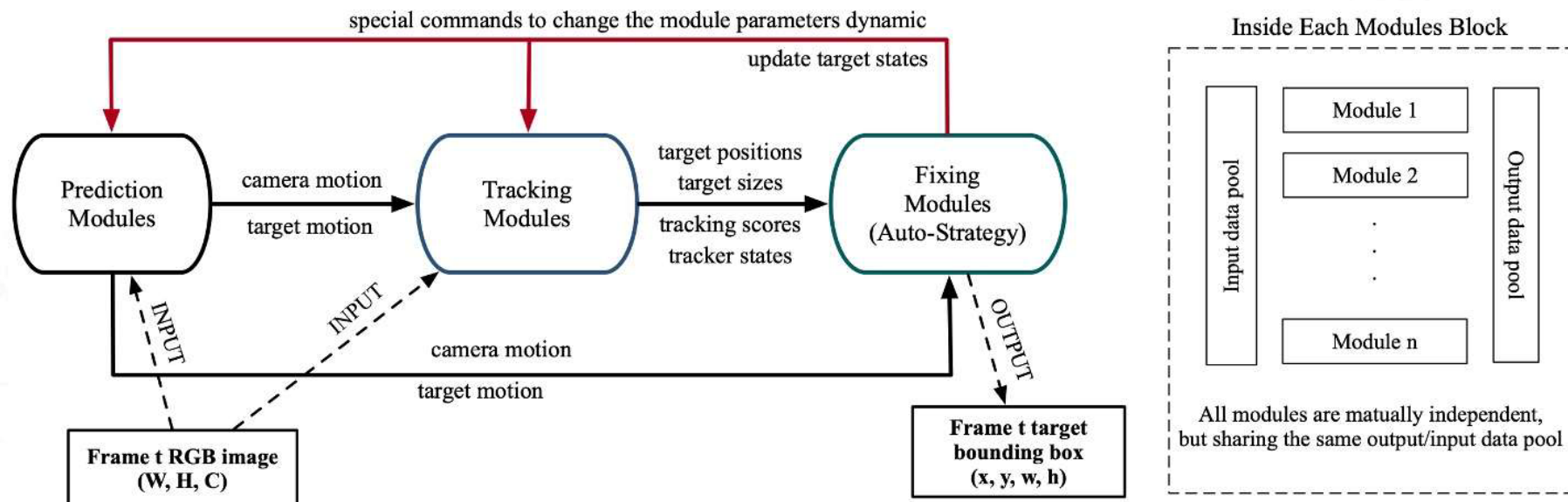
Dalian University of Technology, China

# Task 2: winner talk

## Strategy and motion integrated long-term experts (SMILEv2)

Yuxuan Li<sup>1</sup>, Zhongjian Huang<sup>1</sup>, Biao Wang<sup>2</sup>

<sup>1</sup>Xidian University, <sup>2</sup>WeBank, China



# Task 2: winner talk

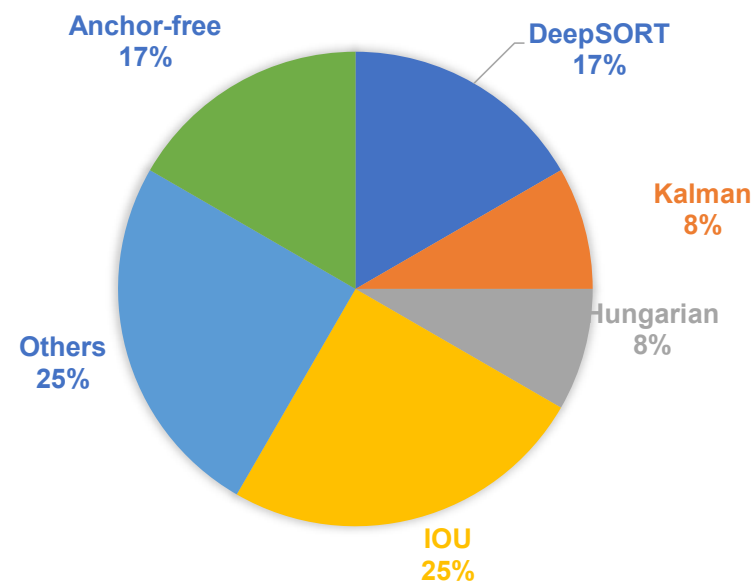
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# Task 3: multi-object tracking

**19** Teams

**1** Winner

**2** Honorable Mention



Method	AP	AP@0.25	AP@0.50	AP@0.75	AP <sub>car</sub>	AP <sub>bus</sub>	AP <sub>trk</sub>	AP <sub>ped</sub>	AP <sub>van</sub>
COFE (A.1)	61.88	64.99	62.00	58.65	79.09	65.26	50.91	56.87	57.26
SOMOT (A.2)	57.65	70.06	60.13	42.75	68.52	62.10	47.98	54.94	54.69
PAS Tracker (A.3)	50.80	62.24	50.74	39.43	62.59	50.59	42.18	44.34	54.30



# Task 3: multi-object tracking

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**Winner**      Coarse-to-Fine Multi-Class Multi-Object Tracking (COFE)

Yuhang He, Wentao Yu, Jie Han, Xiaopeng Hong, Xing Wei, Yihong Gong  
Xi'an Jiaotong University, China

**Honorable  
Mention**

Simple Online Multi-Object Tracker (SOMOT)

Zhipeng Luo, Yuehan Yao, Zhenyu Xu, Bin Dong, Wang Sai  
DeepBlue Technology(Shanghai) Co., Ltd, Shanghai, China

Position-, Appearance- and Size-aware Tracker (PAS tracker)

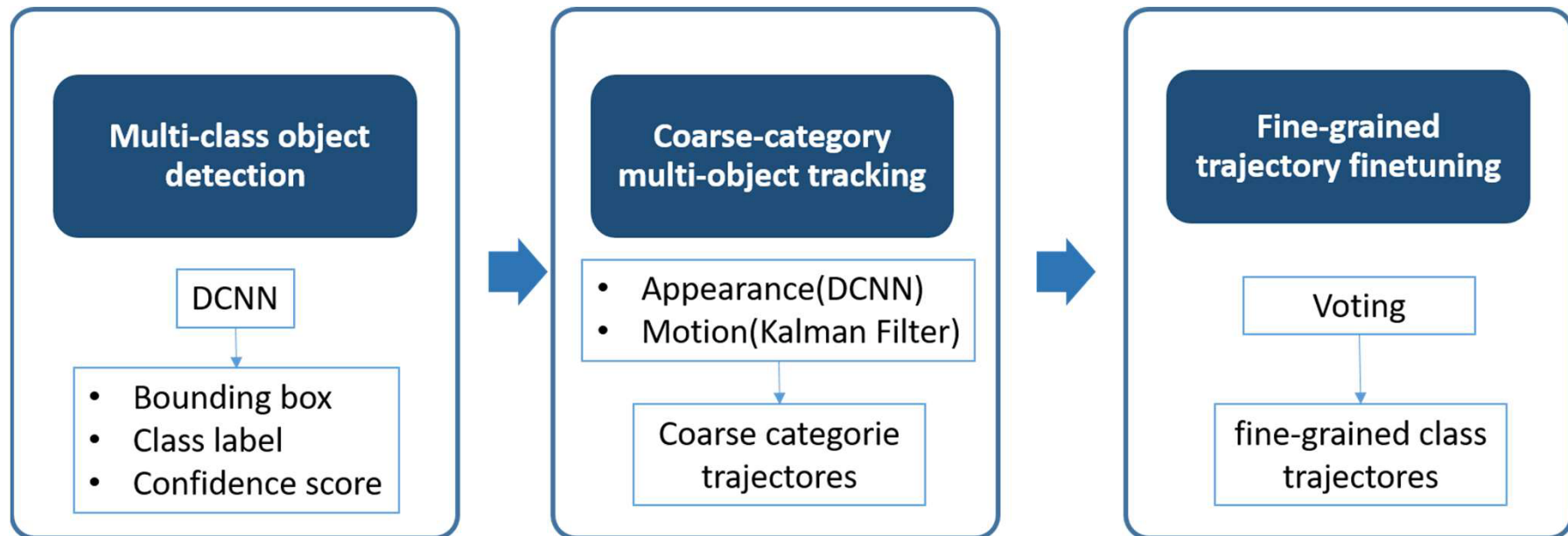
Daniel Stadler<sup>1</sup>, Lars Wilko Sommer<sup>2</sup>, Arne Schumann<sup>3</sup>  
<sup>1</sup>KIT, <sup>2</sup>Fraunhofer IOSB, <sup>3</sup>Fraunhofer Center for Machine Learning, Germany

# Task 3: winner talk

## Coarse-to-Fine Multi-Class Multi-Object Tracking (COFE)

Yuhang He, Wentao Yu, Jie Han, Xiaopeng Hong, Xing Wei, Yihong Gong

Xi'an Jiaotong University, China



# Task 3: winner talk

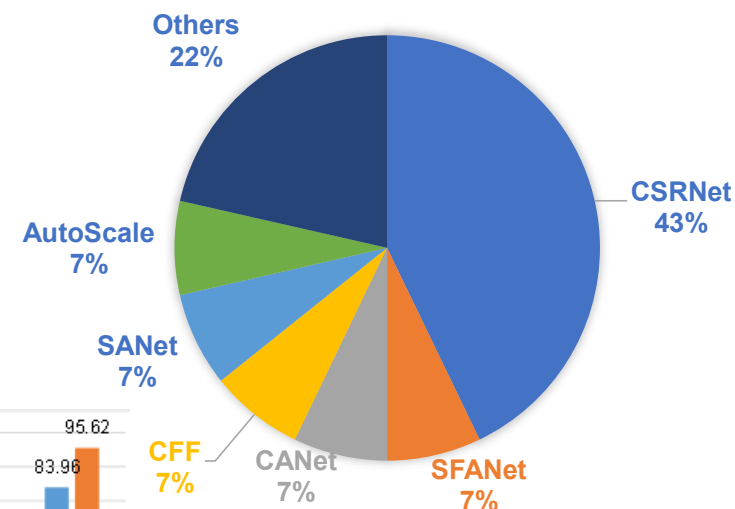
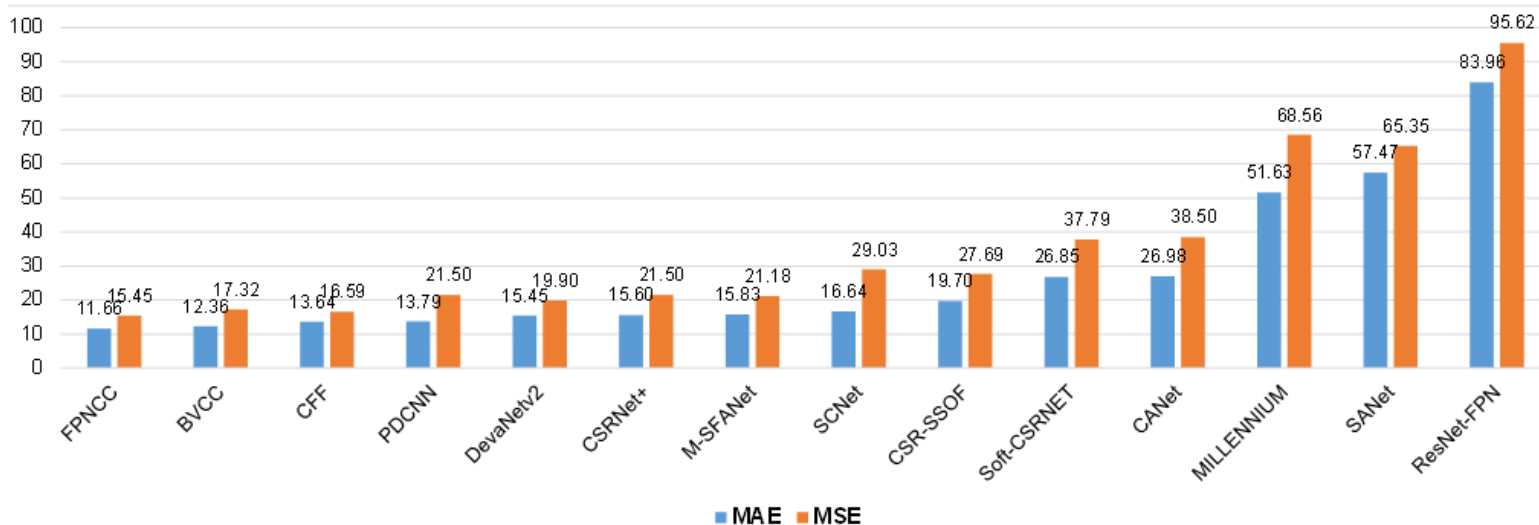


# Task 4: crowd counting

**37** Teams

**1** Winner

**1** Honorable Mention



# Task 4: crowd counting

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## Winner

### Feature Pyramid Network for Crowd Counting (FPNCC)

Dingkang Liang, Chenfeng Xu, Yongchao Xu  
Huazhong University of Science and Technology, China

## Honorable Mention

### Bi-Path Video Crowd Counting (BVCC)

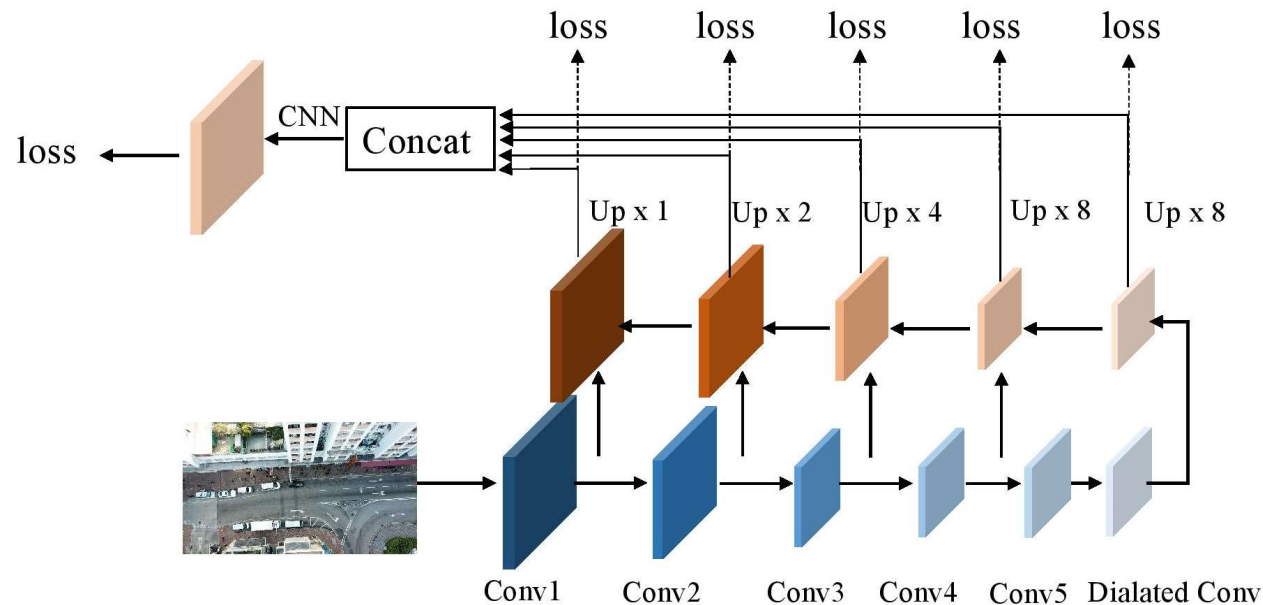
Zhiyuan Zhao, Tao Han, Junyu Gao, Qi Wang, Xuelong Li  
Northwestern Polytechnical University, China

# Task 4: winner talk

## Feature Pyramid Network for Crowd Counting (FPNCC)

Dingkang Liang, Chenfeng Xu, Yongchao Xu

Huazhong University of Science and Technology, China



# Task 4: winner talk



# Advisory Committee

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- Liefeng Bo (JD Digits, USA)
- Hamilton Scott Clouse (US Airforce Research, USA)
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- Riad I. Hammound (BAE Systems, USA)
- David Jacobs (Univ. Maryland College Park, USA)
- Siwei Lyu (Univ. at Albany, SUNY, USA)
- Stan Z. Li (Institute of Automation, Chinese Academy of Sciences, China)
- Fuxin Li (Oregon State Univ., USA)
- Anton Milan (Amazon Research and Development Center, Germany)
- Hailin Shi (JD AI Research, China)
- Siyu Tang (Max Planck Institute for Intelligent Systems, Germany)





**Thank You**  
**Enjoy ECCV!**

