

AI 기반 컴퓨터 비전 시스템의 영상처리
방식 별 응용 연구 · 기술 개발과 상용화 동향

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딥러닝을 이용한 영상 처리 분류

The reality of AI



What people think AI is about



The reality

딥러닝을 이용한 영상 처리 분류

Data Annotation Tools – **Polygon-RNN++**

Efficient Annotation of Segmentation Datasets with Polygon-RNN++

David Acuna*^{1,3}

Huan Ling*^{1,2}

Amlan Kar*^{1,2}

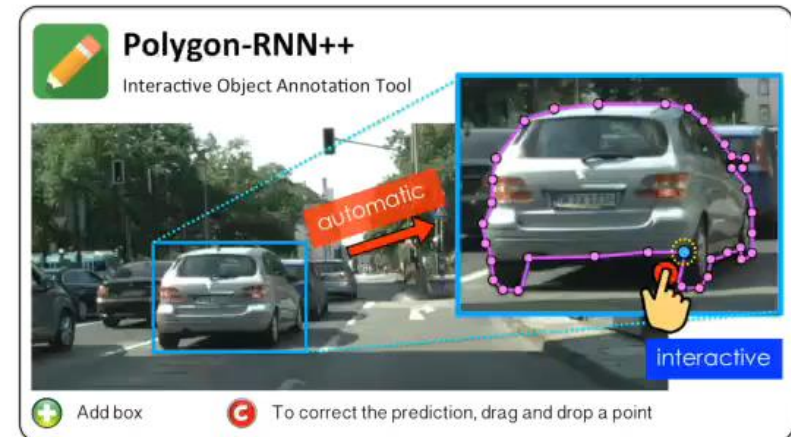
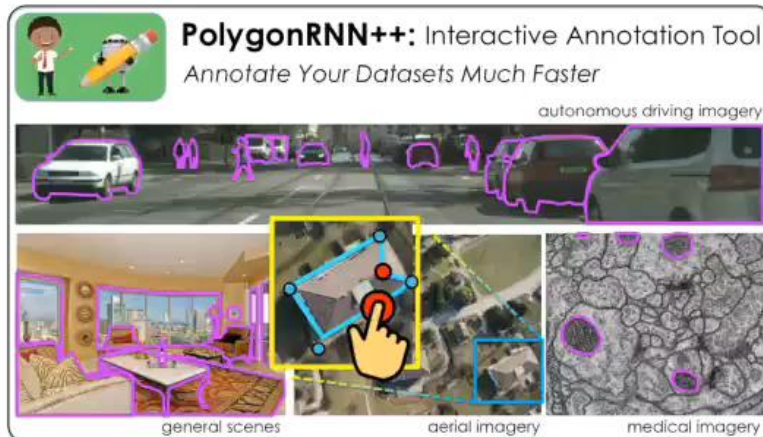
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University of Toronto¹

Vector Institute²

NVIDIA³

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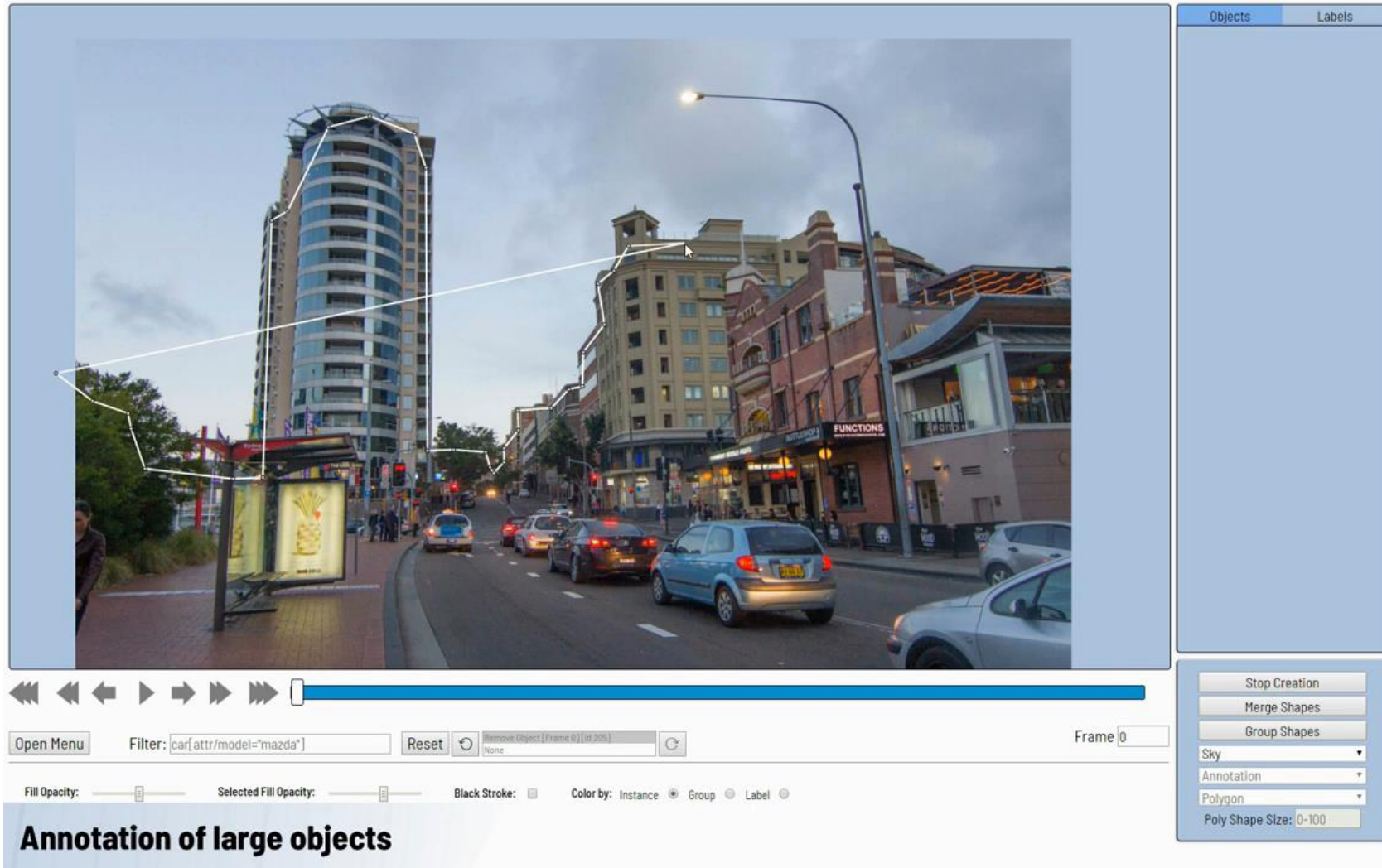
← equal contribution

research done when D.A. at UofT

영상 출처: <http://www.cs.toronto.edu/polyrnn/>

딥러닝을 이용한 영상 처리 분류

Data Annotation Tools – **Computer Vision Annotation Tool**



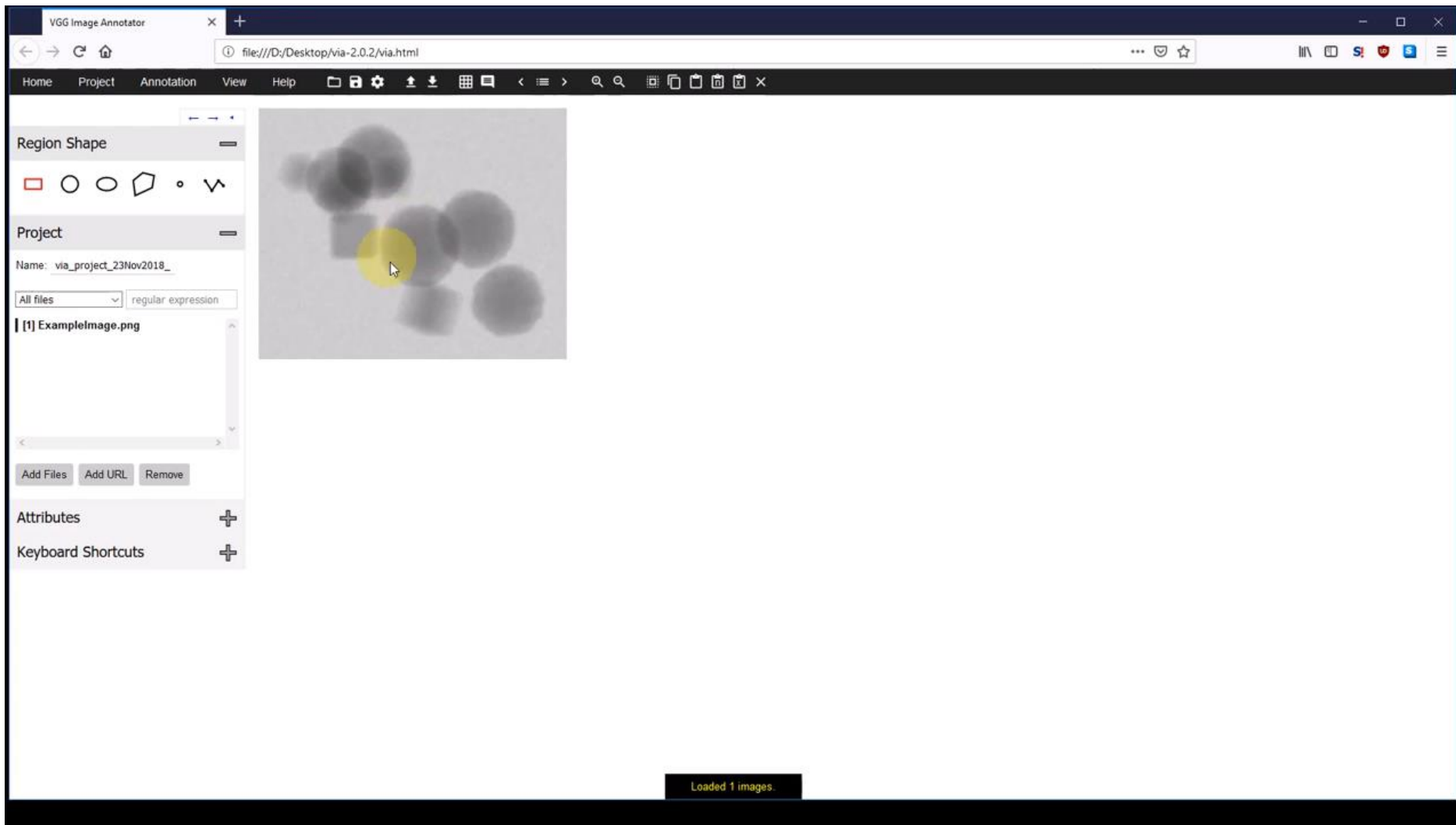
The screenshot displays the CVAT web interface. The main window shows a video frame of a city street at dusk. A large, curved building on the left is outlined with a white polygon. Several cars on the road are also outlined. The interface includes a video player with navigation controls (play, stop, previous, next, full screen) and a progress bar. Below the video player is a filter bar with a text input field containing 'car{attr/model="mazda"}', a 'Reset' button, and a 'Remove Object' button. To the right of the video player is a panel with 'Objects' and 'Labels' tabs. Below these tabs are buttons for 'Stop Creation', 'Merge Shapes', and 'Group Shapes'. At the bottom of this panel are dropdown menus for 'Sky', 'Annotation', and 'Polygon', and a 'Poly Shape Size' slider. The bottom of the interface features a blue banner with the text 'Annotation of large objects'.

Annotation of large objects

영상 출처: <https://github.com/opencv/cvat>

딥러닝을 이용한 영상 처리 분류

Data Annotation Tools – VGG Image Annotator (VIA)



영상 출처: <http://www.robots.ox.ac.uk/~vgg/software/via/>

딥러닝을 이용한 영상 처리 분류

Data Annotation Tools – Uyuni (우유니)



영상 출처: <http://www.xiilab.com/brand/uyuni>

딥러닝을 이용한 영상 처리 분류

Data Annotation Tools – Brain Builder

The screenshot displays the Neurala Brain Builder workspace. At the top, the Neurala logo is on the left, and the video title "Smart City: Figure S..." is in the center. On the right, there are icons for a network, a folder, and a picture, along with the user name "Rakesh Patel". Below the title bar, a "WORKSPACE" tab is active on the left, and the video filename "PatrickCHANS... 1 / 1" is shown on the right. A toolbar with various editing icons is located below the filename. The main area is a video player showing a figure skater on an ice rink. The rink's boards feature logos for "OH change.", "VIA Rail Canada", and "VANCOUVER". A video control bar at the bottom of the player shows a timeline from 00:10:269 to 03:26:709. On the far left, a vertical sidebar contains icons for "Classes" and other tools, with a "100%" zoom indicator at the bottom.

영상 출처: <https://www.neurala.com>

딥러닝을 이용한 영상 처리 분류

3D Object Detection / Segmentation 위주 연구

Classification



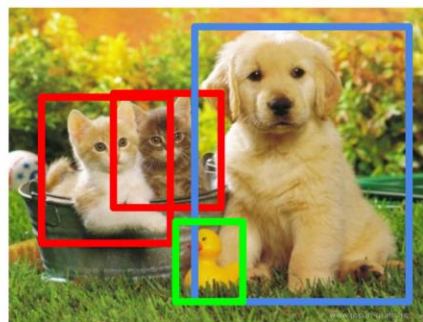
CAT

**Classification
+ Localization**



CAT

Object Detection



CAT, DOG, DUCK

**Instance
Segmentation**



CAT, DOG, DUCK

Single object

Multiple objects

딥러닝을 이용한 영상 처리 분류

Object Detection – KITTI Benchmark, 3D Object Detection

The KITTI Vision Benchmark Suite

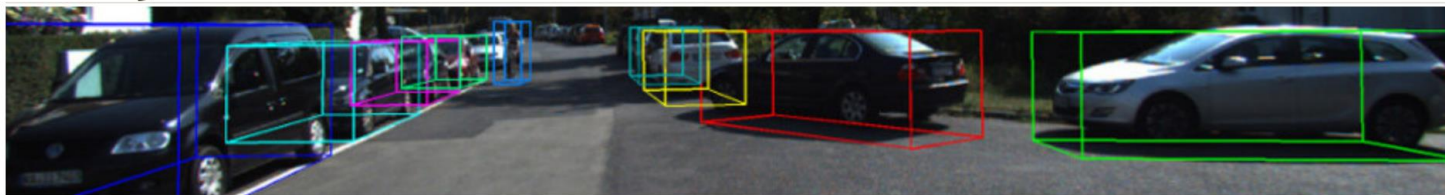
A project of Karlsruhe Institute of Technology and Toyota Technological Institute at Chicago



home setup stereo flow sceneflow depth odometry **object** tracking road semantics raw data submit results

Andreas Geiger (MPI Tübingen) | Philip Lenz (KIT) | Christoph Stiller (KIT) | Raquel Urtasun (University of Toronto)

3D Object Detection Evaluation 2017



Car

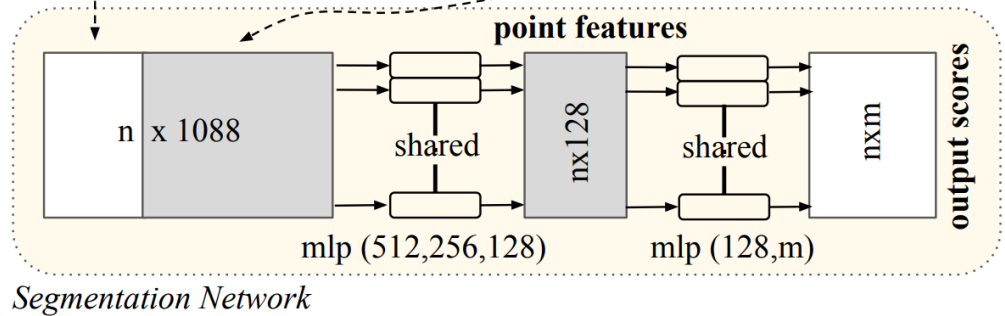
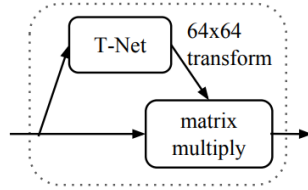
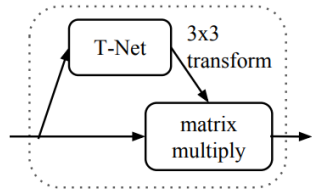
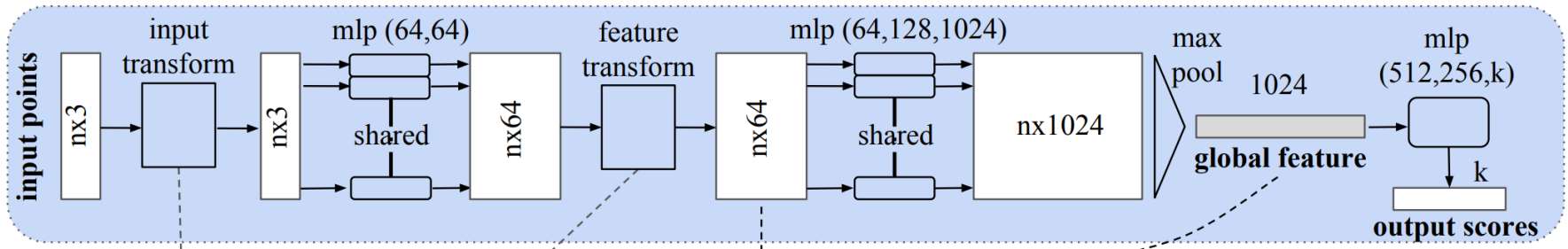
	Method	Setting	Code	<u>Moderate</u>	Easy	Hard	Runtime	Environment	Compare
1	EMP			77.20 %	87.85 %	72.78 %	0.5 s	GPU @ 2.5 Ghz (Python)	<input type="checkbox"/>
2	Patches			77.16 %	87.87 %	68.91 %	0.15 s	GPU @ 2.0 Ghz	<input type="checkbox"/>
3	UberATG-MMF			76.75 %	86.81 %	68.41 %	0.08 s	GPU @ 2.5 Ghz (Python)	<input type="checkbox"/>
M. Liang*, B. Yang*, Y. Chen, R. Hu and R. Urtasun: Multi-Task Multi-Sensor Fusion for 3D Object Detection, CVPR 2019.									
4	F-ConvNet			76.51 %	85.88 %	68.08 %	0.47 s	GPU @ 2.5 Ghz (Python + C/C++)	<input type="checkbox"/>
Z. Wang and K. Jia: Frustum-ConvNet: Sliding Frustums to Aggregate Local Point-Wise Features for Amodal 3D Object Detection, arXiv preprint arXiv:1903.01664 2019.									
5	Voxel-FPN			75.95 %	85.57 %	67.84 %	0.02 s	GPU @ 2.5 Ghz (Python + C/C++)	<input type="checkbox"/>

이미지 출처: http://www.cvlibs.net/datasets/kitti/eval_object.php?obj_benchmark=3d

딥러닝을 이용한 영상 처리 분류

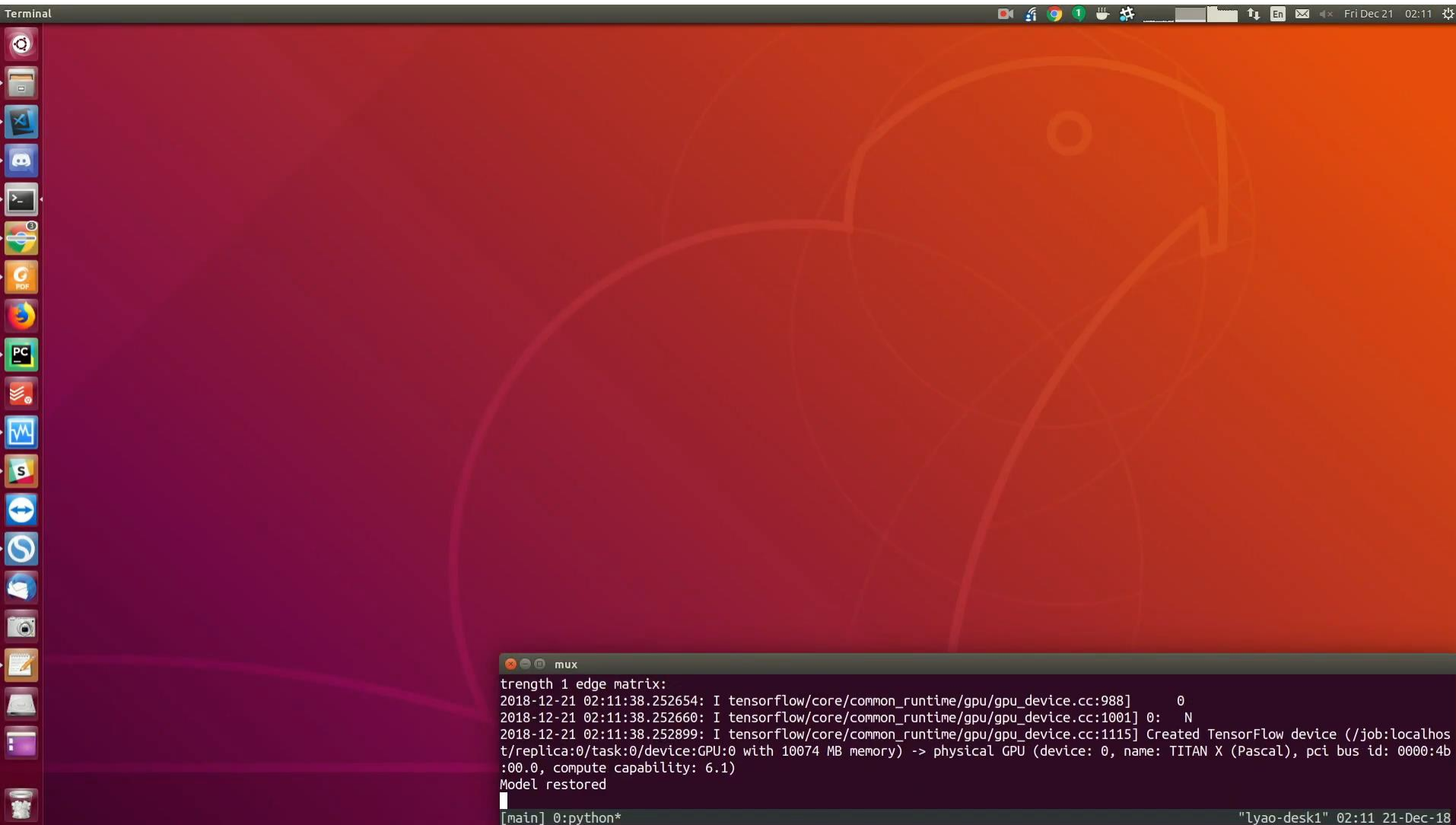
Object Detection – PointNet

Classification Network



딥러닝을 이용한 영상 처리 분류

Object Detection – PointNet



The screenshot shows a Linux desktop environment. The background is a red and orange gradient with a faint, stylized outline of a human head. On the left side, there is a vertical dock with various application icons including a terminal, file manager, and web browser. At the top, a terminal window is open, displaying the following output:

```
Terminal
2018-12-21 02:11:38.252654: I tensorflow/core/common_runtime/gpu/gpu_device.cc:988] 0
2018-12-21 02:11:38.252660: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1001] 0: N
2018-12-21 02:11:38.252899: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1115] Created TensorFlow device (/job:localhos
t/replica:0/task:0/device:GPU:0 with 10074 MB memory) -> physical GPU (device: 0, name: TITAN X (Pascal), pci bus id: 0000:4b
:00.0, compute capability: 6.1)
Model restored
[main] 0:python*
```

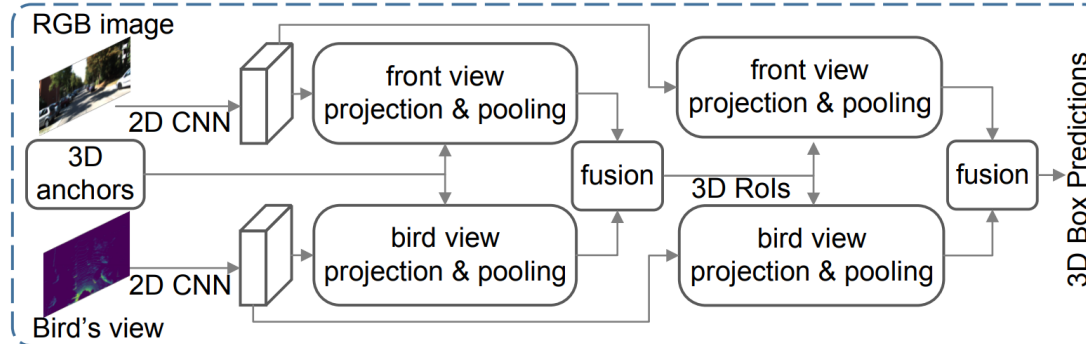
The terminal window title is "mux". The system tray at the bottom right shows the date and time: "Fri Dec 21 02:11" and "21-Dec-18".

영상 출처: https://www.youtube.com/watch?v=cXLG_vgXEO4

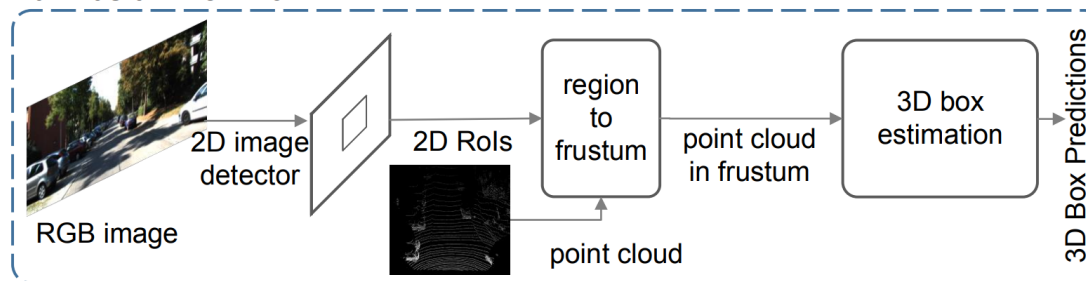
딥러닝을 이용한 영상 처리 분류

Object Detection – PointRCNN: 3D Object Proposal Generation and Detection from Point Cloud

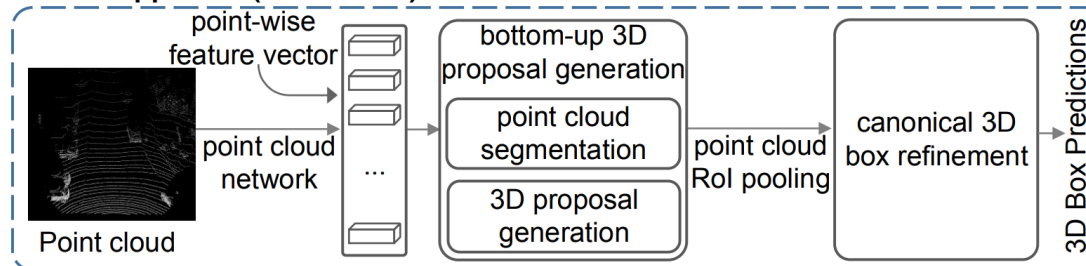
a: Aggregate View Object Detection (AVOD)



b: Frustum-Pointnet

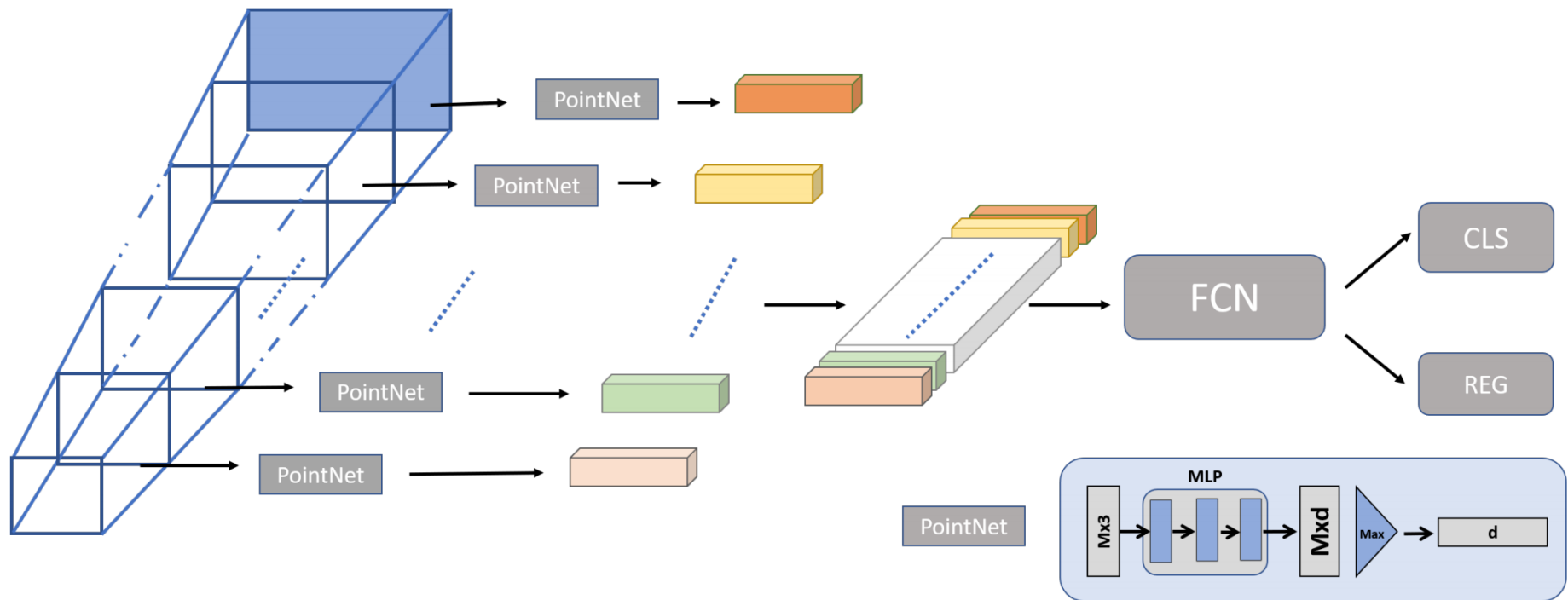


c: Our approach (PointRCNN)



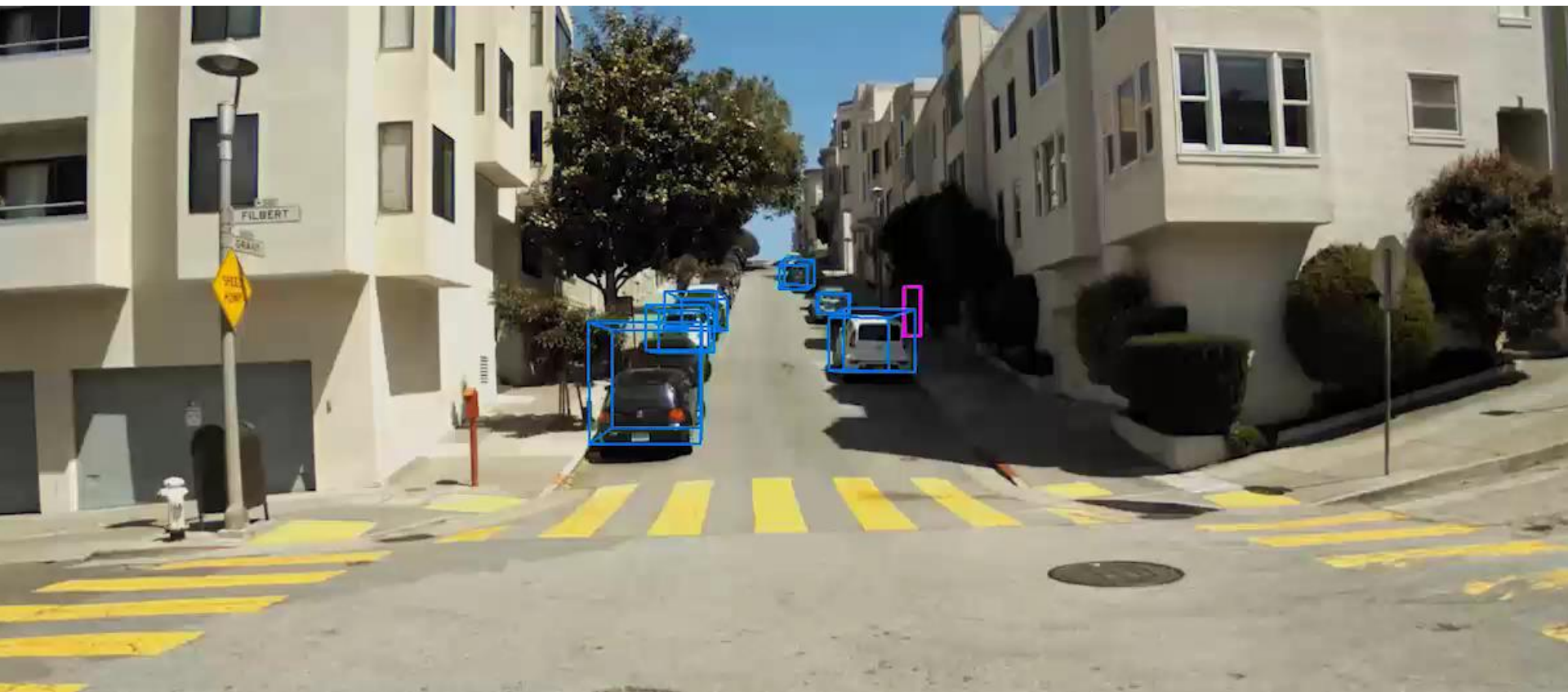
딥러닝을 이용한 영상 처리 분류

Object Detection – Frustum ConvNet: Sliding Frustums to Aggregate Local Point-Wise Features for Amodal 3D Object Detection



딥러닝을 이용한 영상 처리 분류

Object Detection – Zoox



영상 출처: <https://zoox.com/>

딥러닝을 이용한 영상 처리 분류









Pixel-level Semantic Labeling Task



이미지 출처: <https://www.cityscapes-dataset.com/dataset-overview/#features>

딥러닝을 이용한 영상 처리 분류

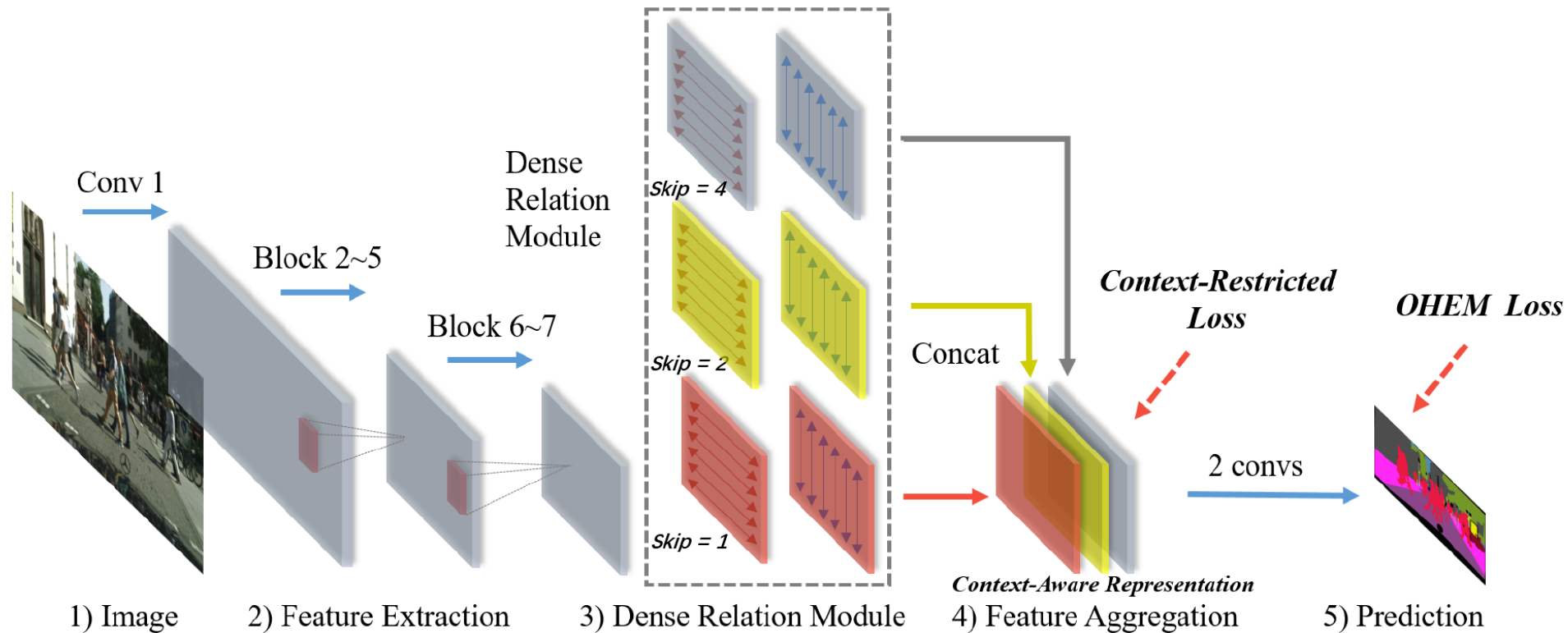
Pixel-level Semantic Labeling Task - Benchmark

name	fine	coarse	16-bit	depth	video	sub	IoU class	IoU class	IoU category	IoU category	Runtime [s]	code
 iFLYTEK-CV	yes	yes	no	no	no	no	83.6	64.7	92.1	82.3	n/a	no
 NV-ADLR	yes	yes	no	no	no	no	83.2	64.2	92.1	82.2	n/a	no
 GALD-net	yes	yes	no	no	no	no	83.1	63.5	92.2	81.4	n/a	yes
 Tencent AI Lab	yes	yes	no	no	no	no	82.9	63.9	91.8	80.4	n/a	no
 DRN_CRL_Coarse	yes	yes	no	no	no	no	82.8	61.1	91.8	80.7	n/a	yes
 DPC	yes	yes	no	no	no	no	82.7	63.3	92.0	82.5	n/a	yes
 SRC-B-MachineLearningLab	yes	yes	no	no	no	no	82.5	60.7	91.8	81.5	n/a	no
 RelationNet_Coarse	yes	yes	no	no	no	no	82.4	61.9	91.8	81.4	n/a	no

이미지 출처: <https://www.cityscapes-dataset.com/benchmarks/#scene-labeling-task>

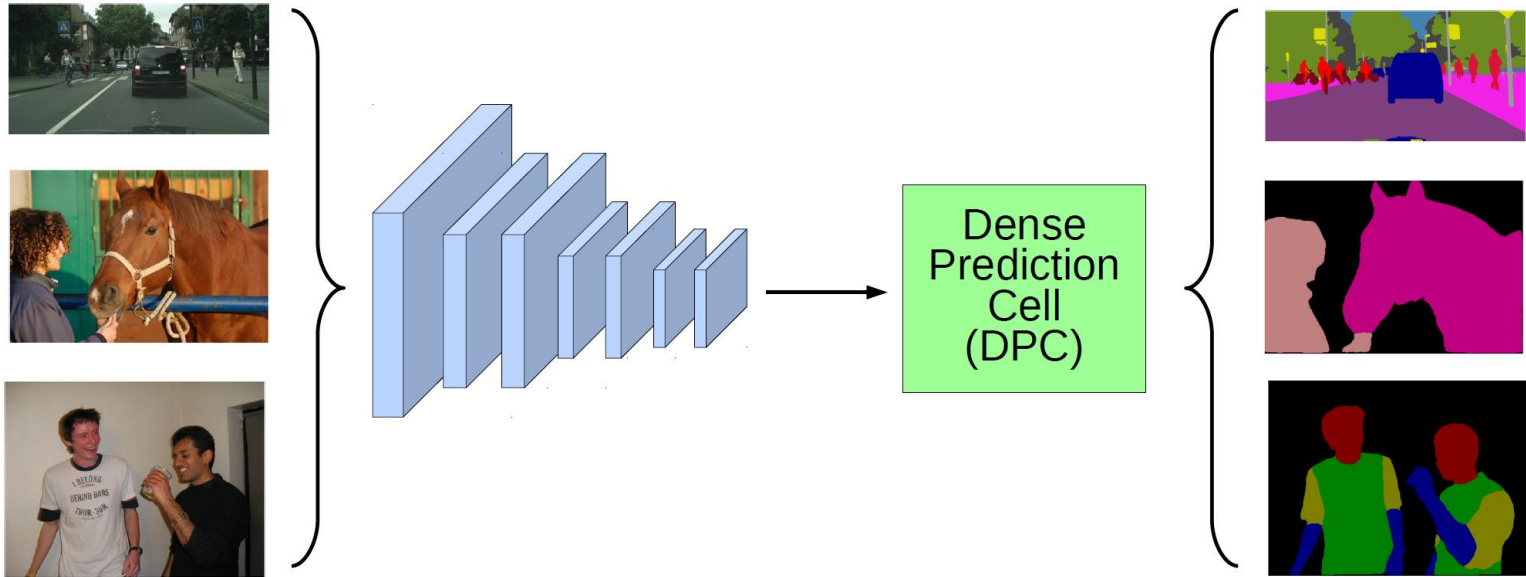
딥러닝을 이용한 영상 처리 분류

Pixel-level Semantic Labeling Task - Dense Relation Network: Learning Consistent and Context-Aware Representation For Semantic Image Segmentation



딥러닝을 이용한 영상 처리 분류

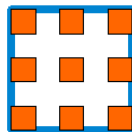
Pixel-level Semantic Labeling Task - Searching for Efficient Multi-Scale Architectures for Dense Image Prediction



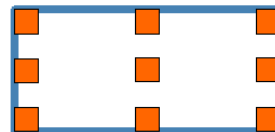
rate = 1x1



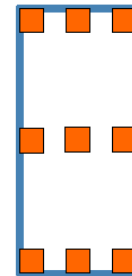
rate = 6x6



rate = 6x24



rate = 24x6



딥러닝을 이용한 영상 처리 분류

Pixel-level Semantic Labeling Task – Video Object Segmentation using Non-local Memory Network

CATEGORY: COMPUTER VISION - 09
P9107 | Joon-Young Lee: jolee@adobe.com

Video Object Segmentation using Non-local Memory Network

Joon-Young Lee Ning Xu Seoung Wug Oh Seon Joo Kim
Adobe Research Yonsei University

➤ Memory Network for Video Object Segmentation

Memory: Past frames with object mask
Query: Current frame

Memory Encoder (Enc_M)
Query Encoder (Enc_Q)
Decoder (Dec)
Space-time Memory Read

➤ Space-Time Memory Read

Read y
Locate
softmax
Skip connections
Decoder

➤ Visualization of Space-Time Memory Read

Memory frames
Query Area / Point

➤ Qualitative Results of Semi-Supervised Video Object Segmentation

➤ Quantitative Evaluation

Youtube-VOS

	Seen		Unseen	
Overall	\mathcal{J}	\mathcal{F}	\mathcal{J}	\mathcal{F}
OSMN [-]	51.2	60.0	60.1	40.6
MSK [-]	53.1	59.9	59.5	45.0
RGMP [-]	53.8	59.5	-	45.2
OuAVOS [-]	55.2	60.1	62.7	46.5
OSVOS [-]	58.8	59.8	60.5	54.2
S2S [-]	64.4	71.0	70.0	55.5
GAM [-]	66.0	66.9	-	61.2
Ours	79.4	79.7	84.2	72.8

DAVIS 2017

	\mathcal{J} Mean	\mathcal{F} Mean
OSMN [-]	52.5	57.1
FAVOS [-]	54.6	61.8
VidMatch [-]	56.5	-
OSVOS [-]	56.6	63.9
MaskRNN [-]	60.5	-
OuAVOS [-]	64.5	71.2
OSVOS ² [-]	64.7	71.3
RGMP [-]	64.8	68.6
CINN [-]	67.2	74.2
GAM (+VV) [-]	67.2	-
FEEL (+VV) [-]	69.1	74.0
DyeNet [-]	*74.1	-
PreMVOS [-]	74.3	82.2
Ours	69.2	74.0
Ours (+VV)	79.2	84.3

DAVIS 2016

	OL?	\mathcal{J} Mean	\mathcal{F} Mean	Time
S2S (+VV) [-]	✓	79.1	-	9s
MSK [-]	✓	79.7	75.4	12s
OSVOS [-]	✓	79.8	80.6	9s
LCT [-]	✓	80.5	77.6	-
MaskRNN [-]	✓	80.7	80.9	-
VidMatch [-]	-	81.0	-	0.32s
FEEL (+VV) [-]	✓	81.1	82.2	0.45s
RGMP [-]	✓	81.3	82.0	0.13s
GAM (+VV) [-]	✓	82.0	-	0.07s
FAVOS [-]	✓	82.4	79.5	1.8s
LSE [-]	✓	82.9	80.3	-
CINN [-]	✓	83.4	85.0	>30s
PreMVOS [-]	✓	84.9	88.6	>30s
OSVOS ² [-]	✓	85.6	86.4	4.5s
OuAVOS [-]	✓	86.1	84.9	13s
DyeNet [-]	✓	86.2	-	2.32s
Ours	✓	84.8	88.1	0.16s
Ours (+VV)	✓	88.7	89.9	0.16s

This work was demoed at Adobe MAX 2018 Sneaks as FastMask
<https://youtu.be/GPVx4Tg9EZ0>

Adobe Research Yonsei University

딥러닝을 이용한 영상 처리 분류

Pixel-level Semantic Labeling Task – Video Object Segmentation using Non-local Memory Network



영상 출처: <https://www.youtube.com/watch?v=GPVx4Tg9EZ0&feature=youtu.be>

딥러닝을 이용한 영상 처리 분류

ETC - SuperDepth

SuperDepth: Self-Supervised, Super-Resolved, Monocular Depth Estimation
 Sudeep Pillai, Rares Ambrus, Adrien Gaidon
 Toyota Research Institute

MOTIVATION

Why MonoDepth?

- LiDAR: Expensive, Sparse
- Cameras: Rich spatio-temporal, semantic understanding, low-cost, versatile and ubiquitous

Why Self-Supervised in Autonomous Vehicles?

- Large volumes of structured but **unlabeled** data
- Natural synchronization of sensor streams
- Curating labeled data can be time-consuming, difficult, and expensive

KEY INSIGHT

- Photometric loss is the key proxy metric in self-supervised disparity estimation

CONTRIBUTIONS

- ★ Sub-Pixel Convolutions for Disparity Super-Resolution (SP)
- ★ Differentiable Flip Augmentation (FA)
- ★ Self-supervised, Scale-Aware Monocular Depth and Pose

RESULTS

QUANTITATIVE RESULTS

Method	Resolution	Disparity	Trunc	Abs. Rel.	Sq. Rel.	RMSE	RMSE log	$d < 1.25$	$d < 1.25^2$
DeepV2 [10]	400x100	R	0.180	1.080	5.100	0.217	0.740	0.904	0.962
DeepV2 [10]	600x150	R	0.129	1.112	5.180	0.209	0.841	0.912	0.978
DeepV2 [10]	800x200	R	0.101	1.206	5.517	0.204	0.876	0.885	0.974
DeepV2 [10]	1024x256	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	1280x320	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	1536x384	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	1792x448	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	2048x512	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	2304x576	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	2560x640	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	2816x704	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	3072x768	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	3328x832	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	3584x896	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	3840x960	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	4096x1024	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	4352x1088	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	4608x1152	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	4864x1216	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	5120x1280	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	5376x1344	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	5632x1408	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	5888x1472	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	6144x1536	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	6400x1600	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	6656x1664	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	6912x1728	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	7168x1792	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	7424x1856	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	7680x1920	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	7936x1984	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	8192x2048	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	8448x2112	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	8704x2176	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	8960x2240	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	9216x2304	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	9472x2368	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	9728x2432	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	9984x2496	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	10240x2560	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	10496x2624	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	10752x2688	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	11008x2752	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	11264x2816	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	11520x2880	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	11776x2944	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	12032x3008	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	12288x3072	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	12544x3136	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	12800x3200	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	13056x3264	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	13312x3328	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	13568x3392	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	13824x3456	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	14080x3520	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	14336x3584	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	14592x3648	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	14848x3712	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	15104x3776	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	15360x3840	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	15616x3904	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	15872x3968	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	16128x4032	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	16384x4096	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	16640x4160	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	16896x4224	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	17152x4288	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	17408x4352	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	17664x4416	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	17920x4480	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	18176x4544	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	18432x4608	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	18688x4672	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	18944x4736	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	19200x4800	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	19456x4864	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	19712x4928	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	19968x4992	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	20224x5056	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	20480x5120	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	20736x5184	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	20992x5248	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	21248x5312	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	21504x5376	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	21760x5440	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	22016x5504	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	22272x5568	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	22528x5632	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	22784x5696	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	23040x5760	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	23296x5824	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	23552x5888	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	23808x5952	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	24064x6016	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	24320x6080	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	24576x6144	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	24832x6208	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	25088x6272	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	25344x6336	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	25600x6400	R	0.108	1.308	6.076	0.201	0.876	0.885	0.974
DeepV2 [10]	25856x6464	R	0.108	1.308	6.076	0.2			

SuperDepth

Self-Supervised, Super-Resolved Monocular Depth Estimation

Sudeep Pillai, Rares Ambrus, Adrien Gaidon
Toyota Research Institute (TRI)



Learning Image Restoration without Clean Data, Enhance Grainy Photos with AI

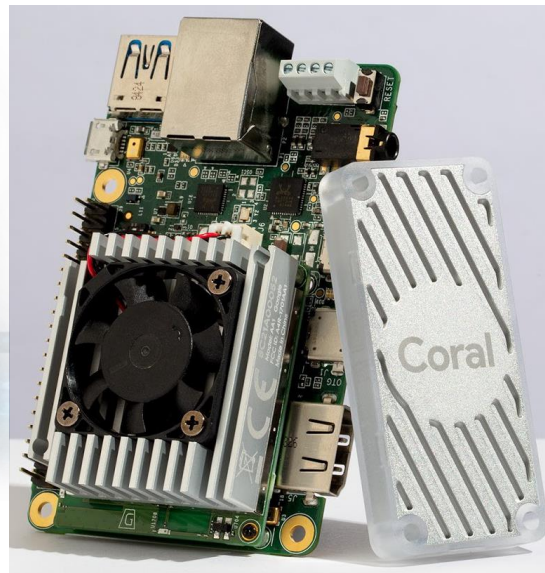
Jaakko Lehtinen, Jacob Munkberg, Jon Hasselgren,
Samuli Laine, Tero Karras, Miika Aittala, and Timo Aila

NVIDIA Corporation, Aalto University, and MIT

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영상 출처: <https://www.youtube.com/watch?v=tBUik7H9GyU&feature=youtu.be>





감사합니다.