



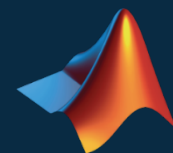
# 세션1. 영상 분석을 위한 딥러닝

MATLAB과 함께하는 딥러닝 4주 완성 부트캠프

송완빈 과장

Application Engineer @ MathWorks

[wsong@mathworks.com](mailto:wsong@mathworks.com)

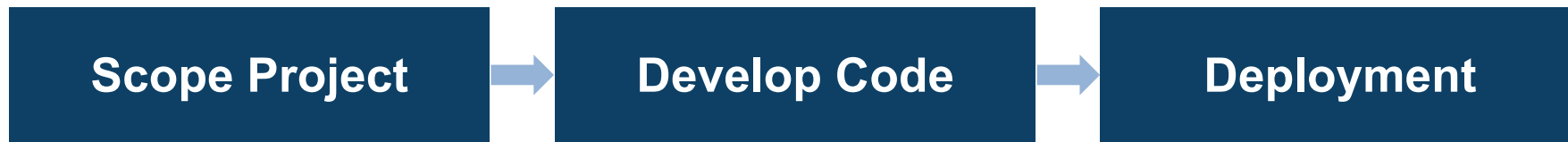


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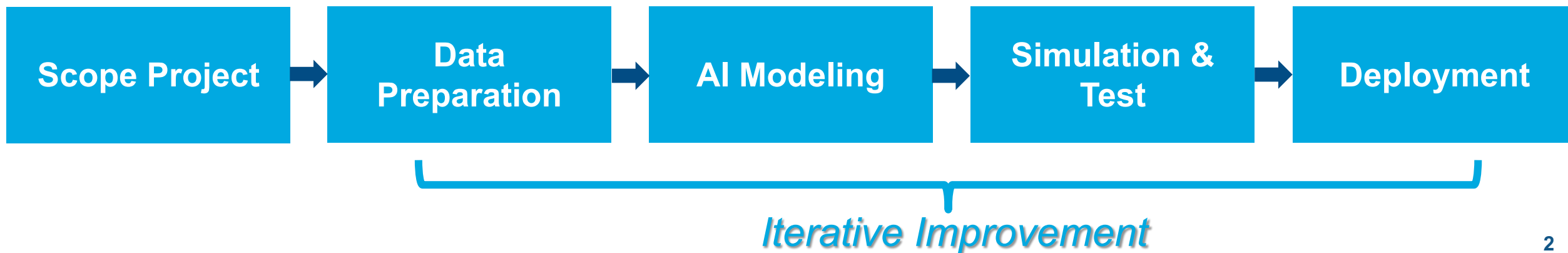
*Accelerating the pace of engineering and science*

# Software System Design

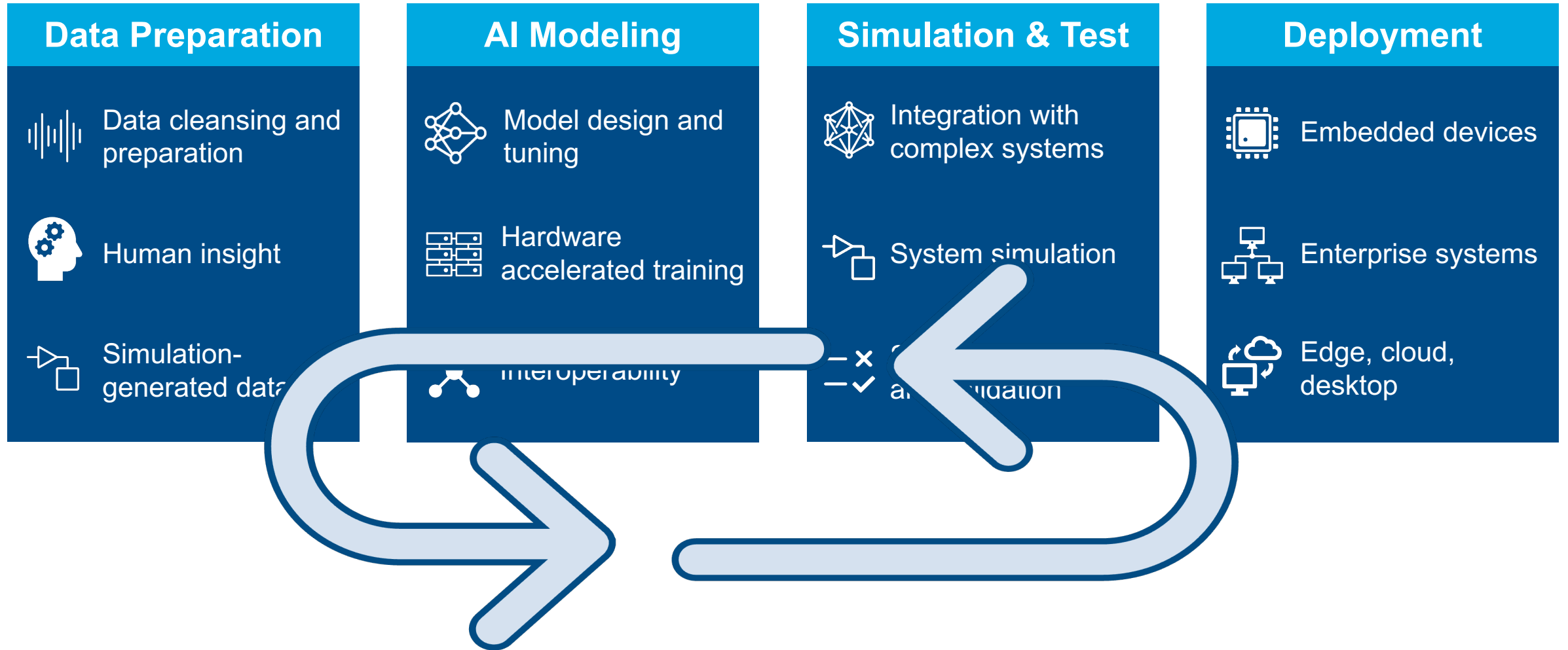
- Traditional Software



- AI Software = Code + Data  
(Model/Algorithm)



# AI-driven system design



*Iterative refinement for system improvement*

# Spend less time preprocessing and labeling data

Preprocess image data using built-in Apps

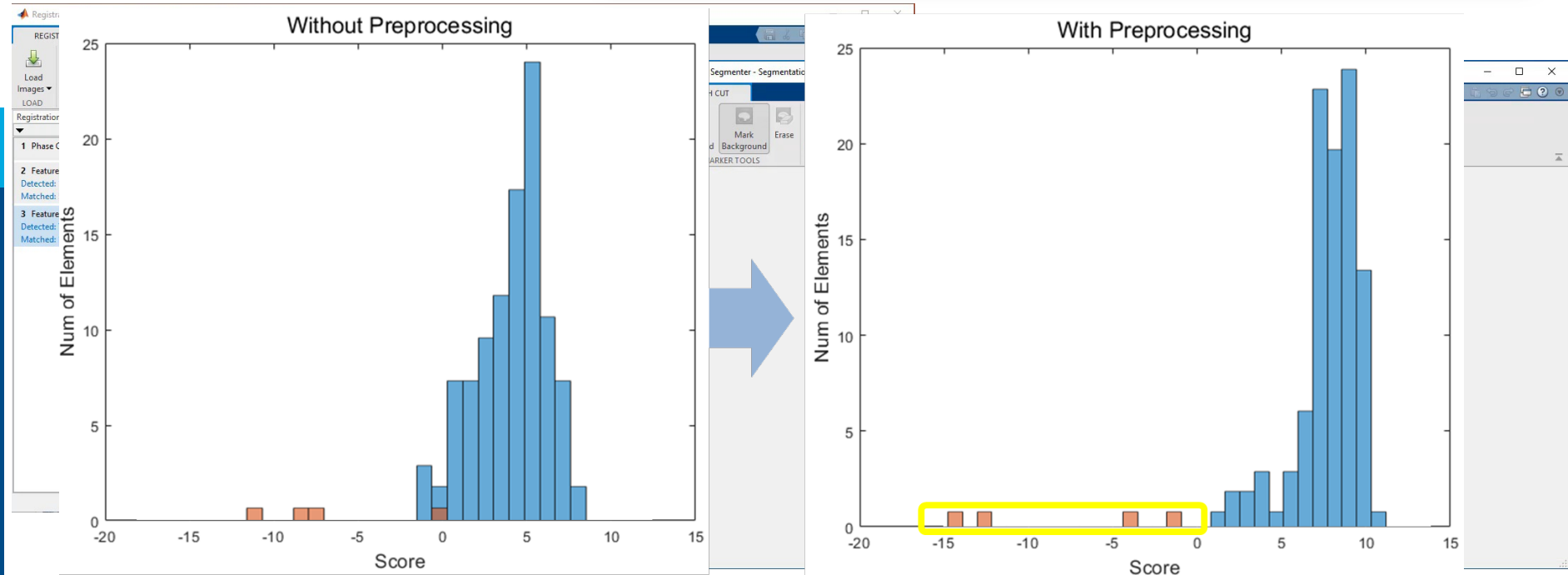
Data

((inputs  $x$ , labels  $y$ ))

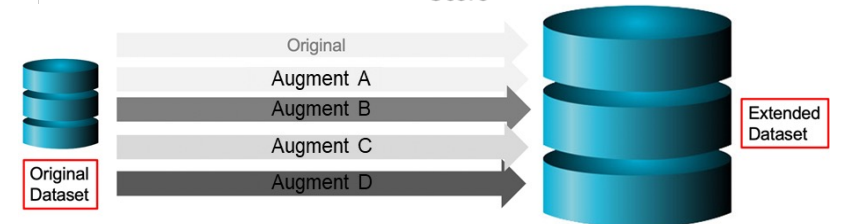


### Data Preparation

- Data cleansing and preparation
- Human insight
- Simulation-generated data



```
>> audioDataAugmenter
>> imageDataAugmenter
```



# Spend less time preprocessing and labeling data

Automate labeling of Lidar, image, video, and signal.

7월 21일

딥러닝  
프로젝트를  
위한 데이터  
준비 기법

<https://bit.ly/3y6CWUD>

Data  
(inputs  $x$ , labels  $y$ )

## Data Preparation



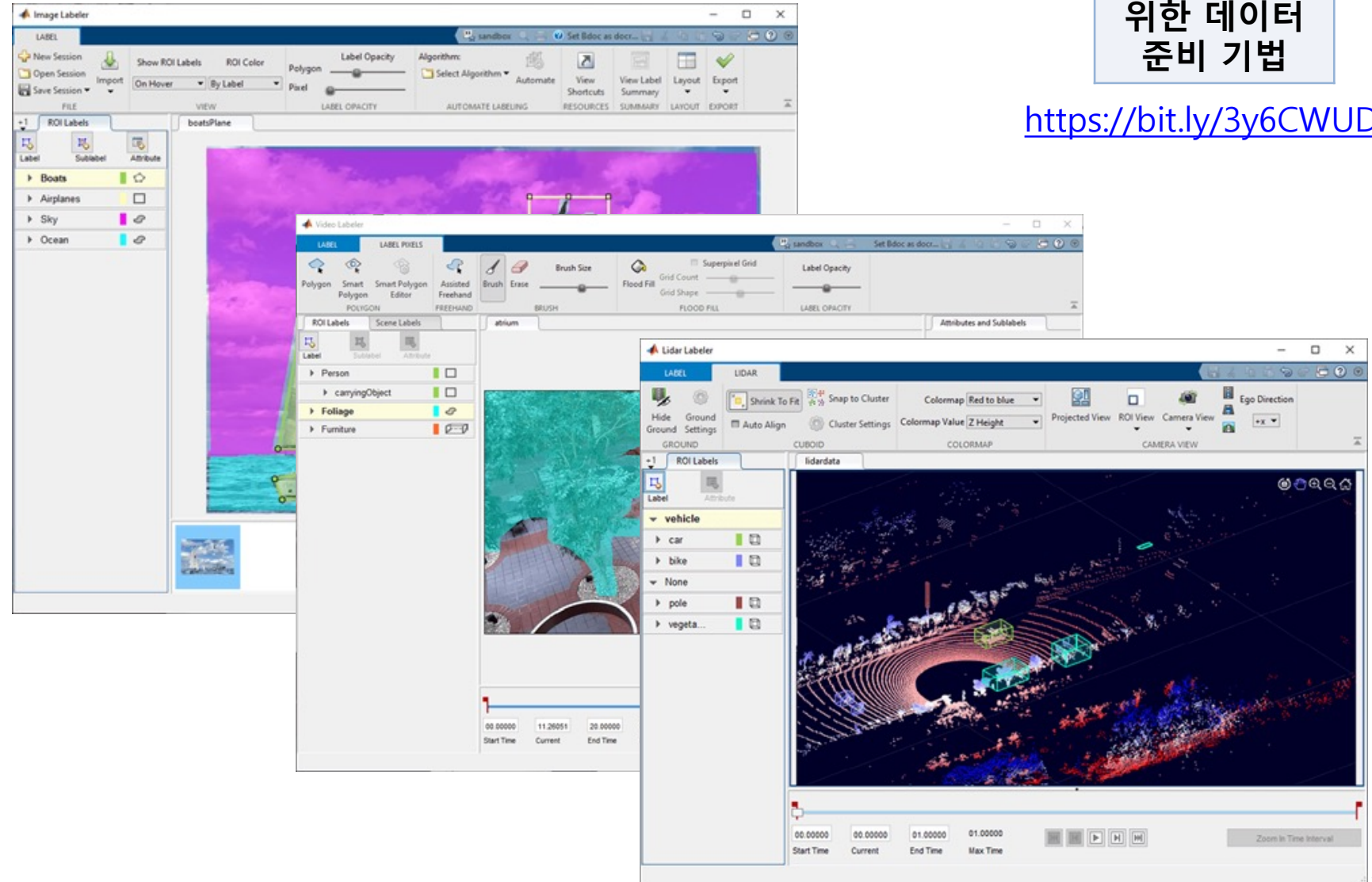
Data cleansing and preparation



Human insight



Simulation-generated data





# Common Deep Learning task for Image and Computer Vision

**AI Modeling**

- Model design and tuning
- Hardware accelerated training
- Interoperability

Image Classification

Object Detection

Semantic Segmentation

CNN (Convolutional Neural Network)

R-CNN series / SSD / YOLO series  
EfficientDet

SegNet / FCN / Unet / Unet3D  
DeepLab v3+



Vision Team

Signal Team

Class Probability

labels		bboxes			
7x1 categorical		7x4 single			
	1	2	3	4	
1	book	591.5063	241.6070	55.6816	45.1555
2	person	28.4991	47.9548	136.4793	368.6172
3	person	157.1649	34.2897	101.9945	375.7617
4	person	261.3463	39.1634	123.7739	345.2696
5	person	387.9937	49.0971	111.1555	328.0656
6	person	506.0469	51.2442	140.1493	351.3738
7	person	655.6837	49.0147	134.4519	367.1317

Bounding Boxes

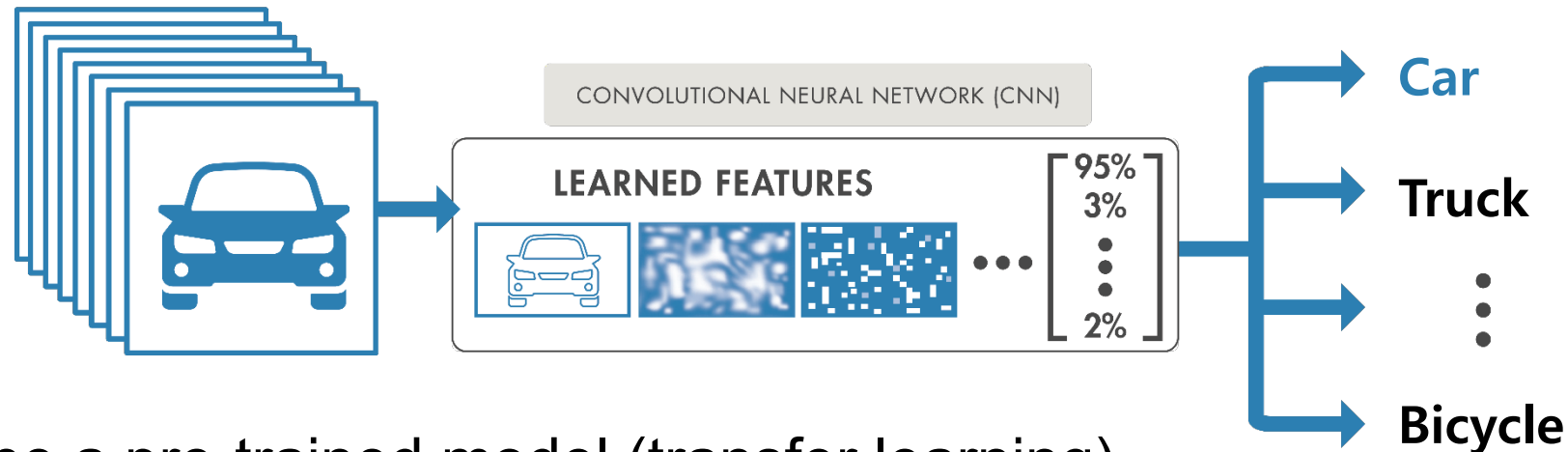
background	background	person
background	person	person
background	person	person
background	person	person

Categorical Image 6

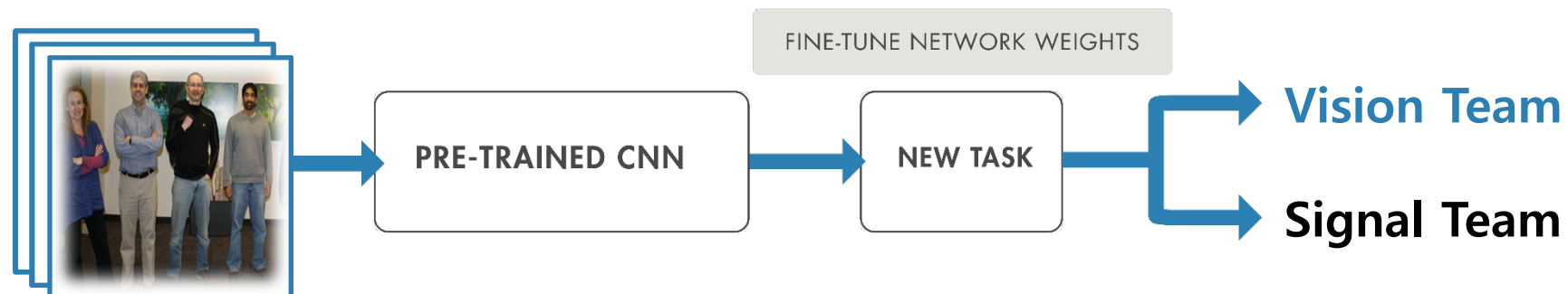
# Two Common Approach for Image classification

## Image Classification

- Train a deep neural network from scratch



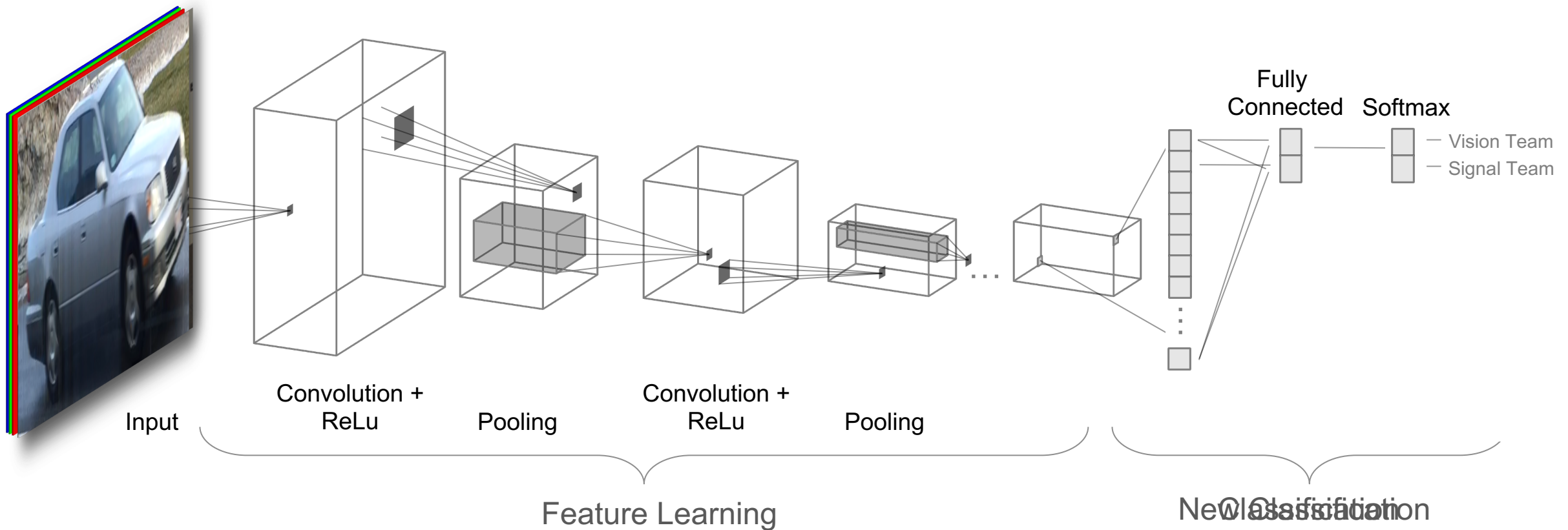
- Fine-tune a pre-trained model (transfer learning)



# Fine-tune a pre-trained model (Transfer learning)

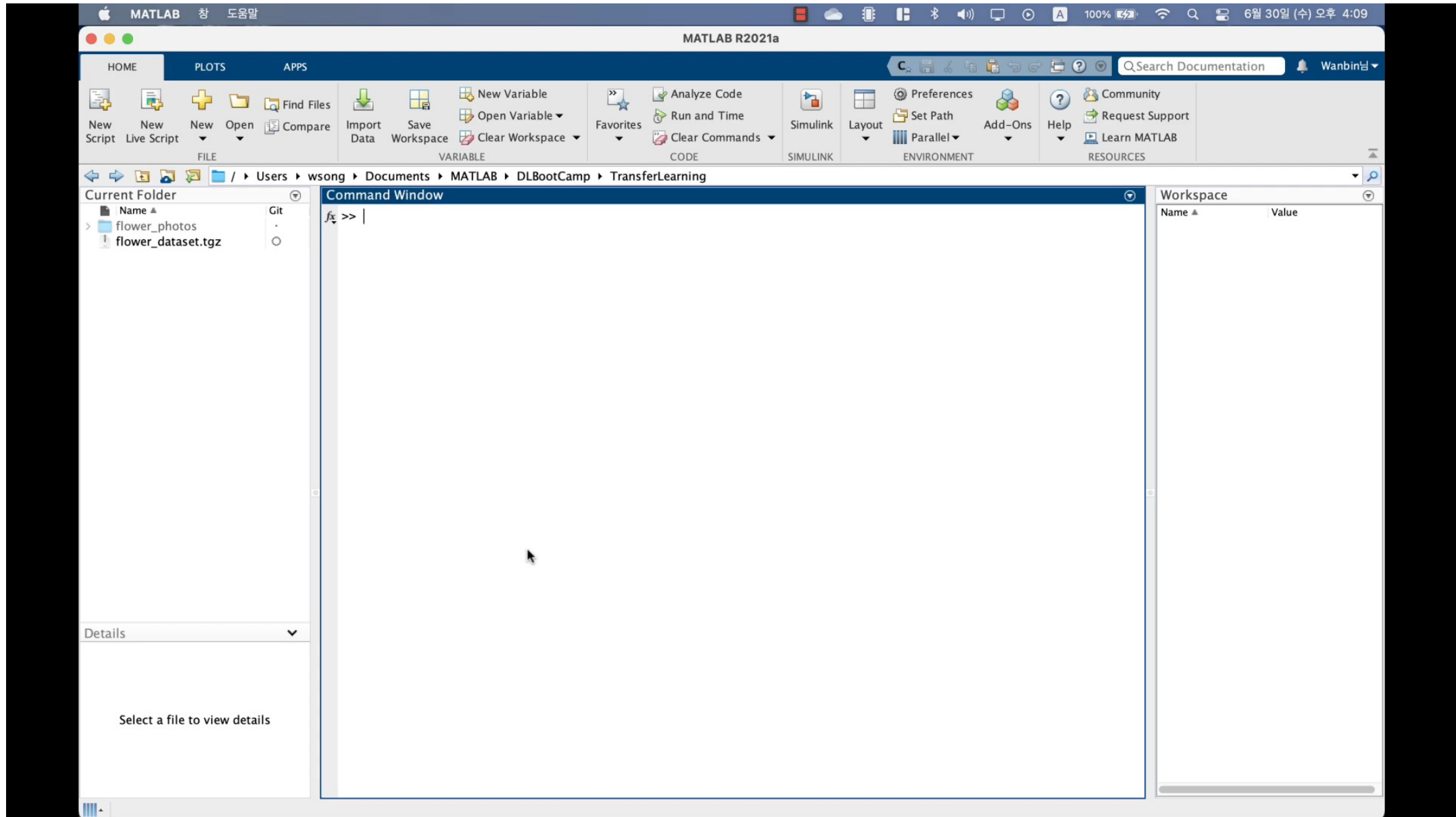
## Image Classification

- Reuse feature extraction layers and replace classification layers





# Leverage apps for improving your transfer learning model



# Object Detection in Image/Vision System

## Object Detection



Object  
Detection



## Object detection

- Computer technology related to computer vision and image processing that deals with **detecting instances of semantic objects** of a certain class (such as humans, buildings, or cars) in digital images and videos

# Detect object using pretrained YOLOv3

The screenshot displays the MATLAB Live Editor interface. The top menu bar includes tabs for HOME, PLOTS, APPS, LIVE EDITOR, INSERT, and VIEW. Below the menu is a toolbar with various icons for file operations, navigation, text formatting, code execution, and running sections. The main workspace shows a document titled 'untitled.mlx' with the following content:

Pretrained YOLOv3로 Object Detection 해보기

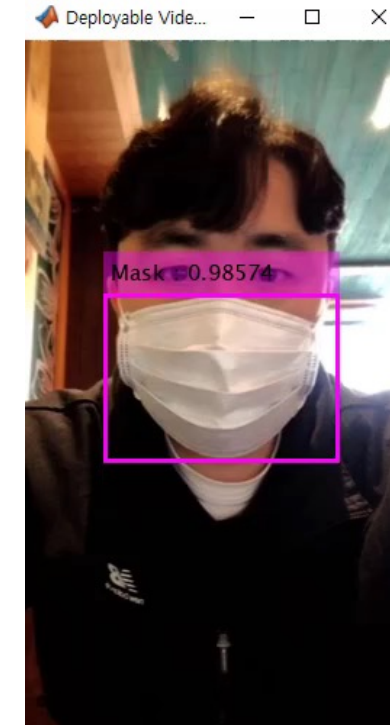
1

The Command Window at the bottom shows the prompt `>>`. The Workspace panel on the right is empty. The status bar at the bottom indicates the encoding is UTF-8, the line ending is LF, and the file type is script. The current position is Ln 1, Col 1.

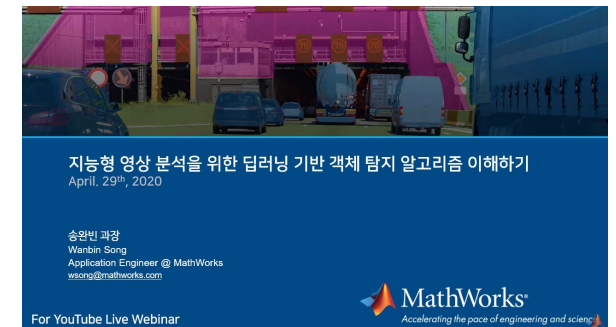
# Speed up development using pretrained detector networks.

Use MATLAB high-level API for changing network type, backbone network for better performance easily.

Variables - newGTruth.DataSource		newGTruth.LabelData				
newGTruth.DataSource		1	2	3	4	
1	ing\COVID_Project\mask\TMWK_dataset\mw_bk1.jpg	Mask				
2	ing\COVID_Project\mask\TMWK_dataset\mw_bk2.jpg	[384,1704,1019,866]				
3	ing\COVID_Project\mask\TMWK_dataset\mw_bk3.jpg	[412,1529,1148,827]				
4	ing\COVID_Project\mask\TMWK_dataset\mw_brian1.JPG	[479,1670,1111,878]				
5	ing\COVID_Project\mask\TMWK_dataset\mw_brian2.JPG	[797,2173,1580,1290]				
6	ing\COVID_Project\mask\TMWK_dataset\mw_brian3.JPG	[847,2277,1521,1158]				
7	ing\COVID_Project\mask\TMWK_dataset\mw_caleb1.jpg	[737,2269,1694,1351]				
8	ing\COVID_Project\mask\TMWK_dataset\mw_caleb2.jpg	[785,1592,1102,1018]				
9	ing\COVID_Project\mask\TMWK_dataset\mw_caleb3.jpg	[864,1712,940,833]				
10	ing\COVID_Project\mask\TMWK_dataset\mw_dennis1.jpg	[887,1573,838,778]				
11	ing\COVID_Project\mask\TMWK_dataset\mw_dennis2.jpg	[416,1452,1107,1032]				
12	ing\COVID_Project\mask\TMWK_dataset\mw_dennis3.jpg	[407,1477,1135,931]				
13	ing\COVID_Project\mask\TMWK_dataset\mw_dy1.jpg	[367,1394,1135,968]				
14	ing\COVID_Project\mask\TMWK_dataset\mw_dy2.jpg	[119,631,505,349]				
15	ing\COVID_Project\mask\TMWK_dataset\mw_gary1.jpg	[121,629,503,372]				
16	ing\COVID_Project\mask\TMWK_dataset\mw_gary2.jpg	[175,464,391,317]				
17	ing\COVID_Project\mask\TMWK_dataset\mw_hj1.jpg	[219,401,338,289]				
18	ing\COVID_Project\mask\TMWK_dataset\mw_hj2.jpg	[118,310,232,161]				
19	ing\COVID_Project\mask\TMWK_dataset\mw_hj3.jpg	[124,316,213,163]				
20	ing\COVID_Project\mask\TMWK_dataset\mw_hj4.JPG	[81,315,250,166]				
21	ing\COVID_Project\mask\TMWK_dataset\mw_hj5.JPG	[72,399,364,255]				
22	ing\COVID_Project\mask\TMWK_dataset\mw_howard1.jpg	[83,410,316,238]				
23	ing\COVID_Project\mask\TMWK_dataset\mw_howard2.jpg	[243,218,163,126]				



Transfer Learning using YOLOv4 pretrained model  
<https://bit.ly/2Uj7AeP>

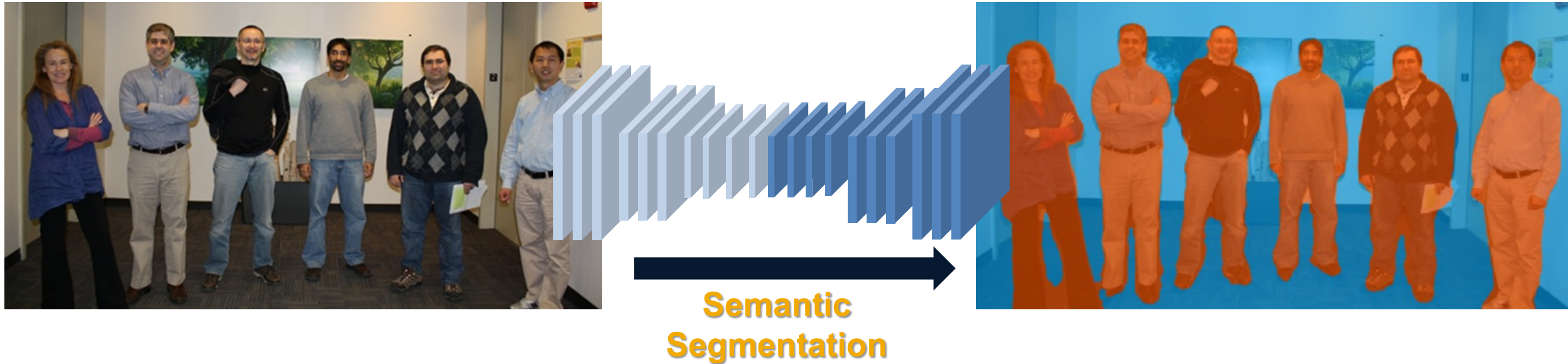


<https://bit.ly/362PzEo>



# What is Semantic Segmentation?

Semantic Segmentation

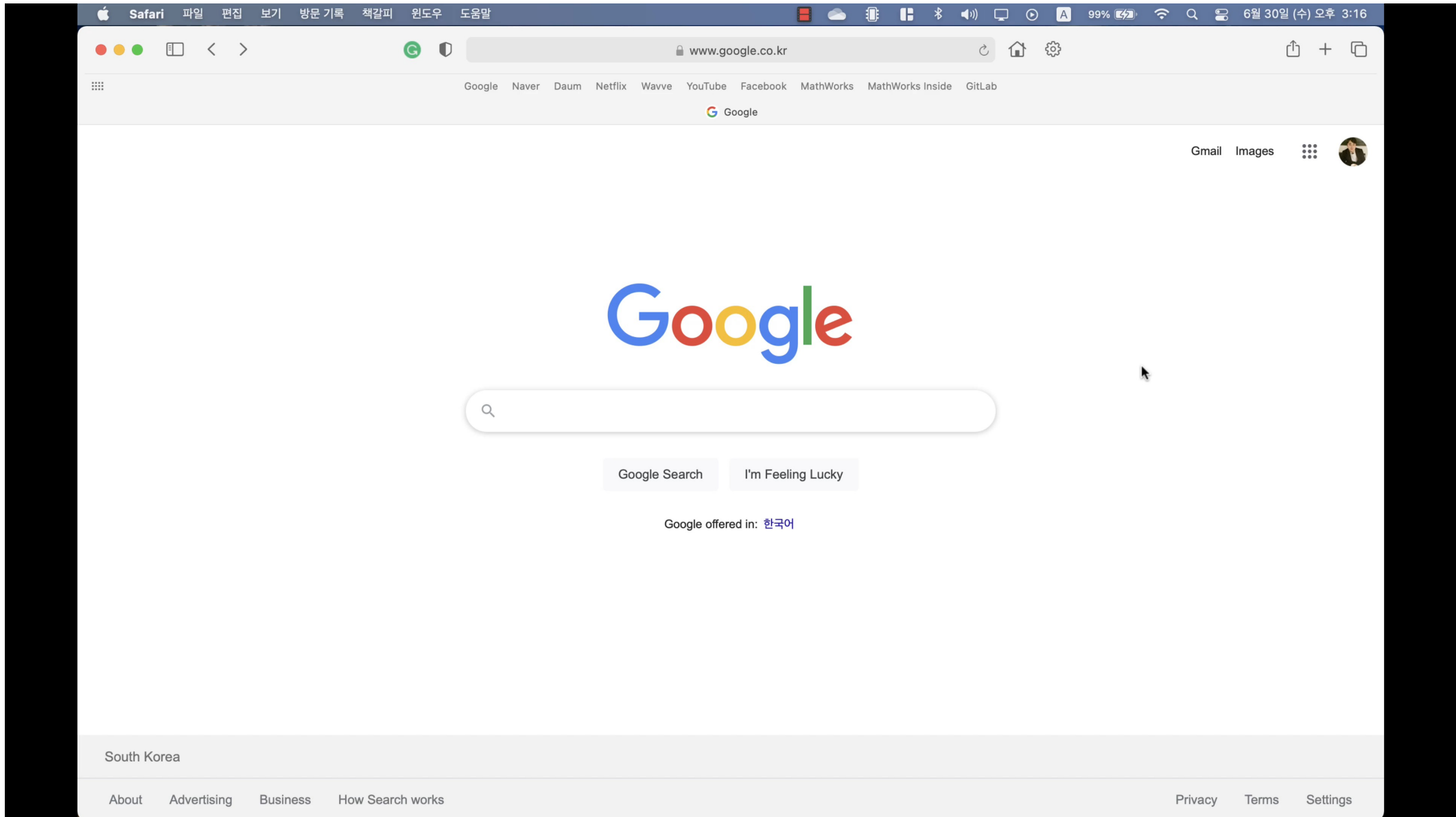


- **Semantic Segmentation**

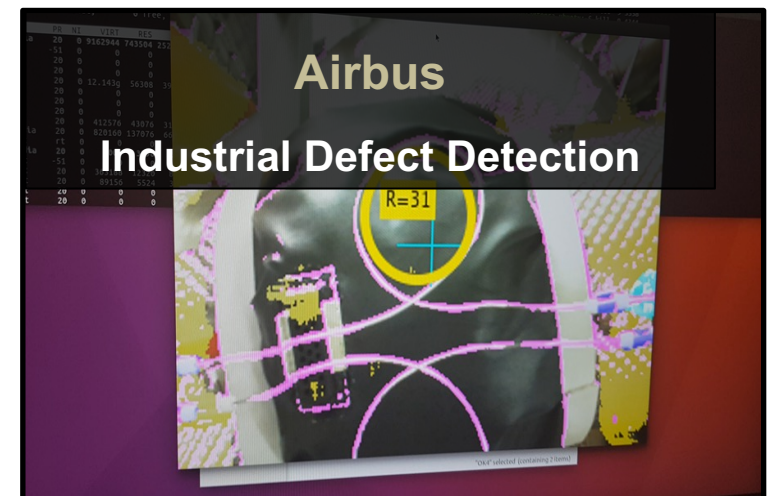
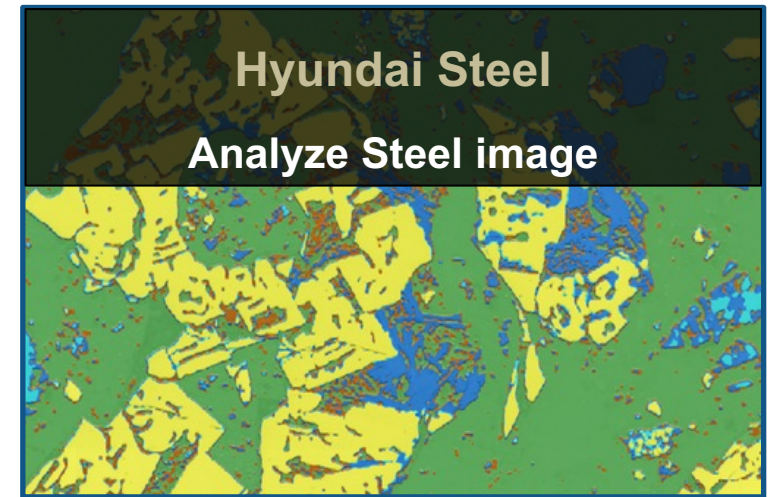
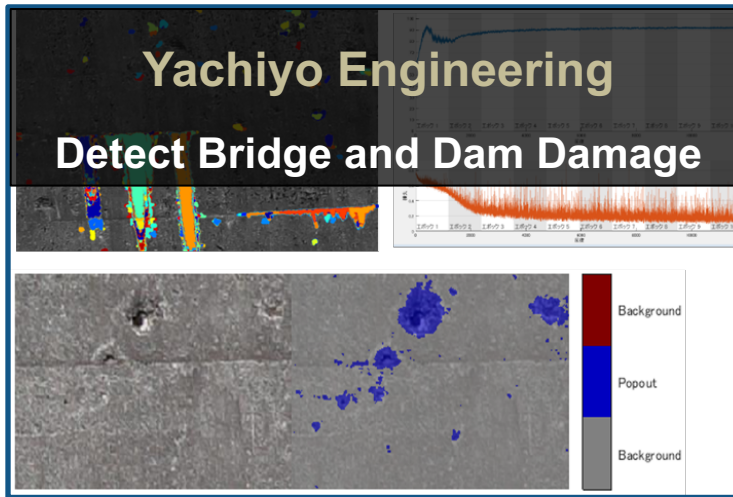
- Associate pixels in an image, video or point cloud to class labels (semantic segmentation) or instances (instance segmentation).



# Classify each pixels using pretrained DeepLab v3+ network



# MATLAB users solve a diverse set of engineering problems using same semantic segmentation technique



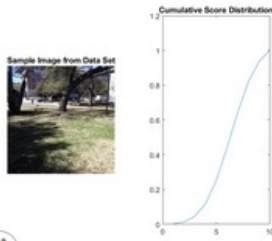


# Extensive Examples for Deep Learning Use Cases



## Remove Noise from Color Image Using Pretrained Neural Network

Remove Gaussian noise from an RGB image by using a pretrained denoising neural network on each color channel independently.



## Quantify Image Quality Using Neural Image Assessment

Analyze the aesthetic quality of images using a Neural Image Assessment (NIMA) convolutional neural network (CNN).



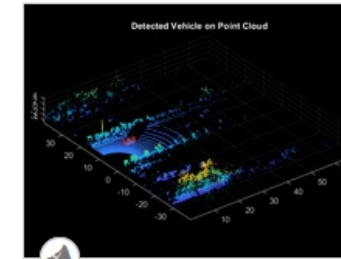
## Automate Ground Truth Labeling for Semantic Segmentation

Use a pretrained semantic segmentation algorithm to segment the sky and road in an image, and use this algorithm to automate



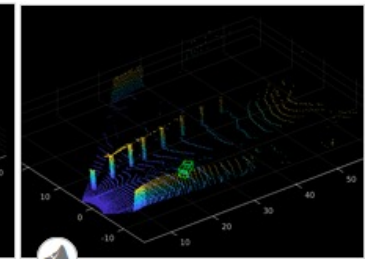
## Object Detection Using YOLO v3 Deep Learning

Detect objects using you look only once version 3 network.



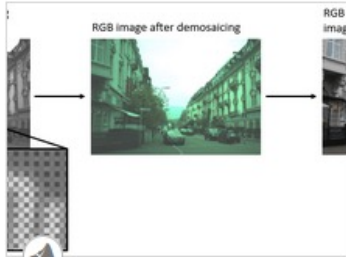
## Automate Ground Truth Labeling For Vehicle Detection Using PointPillars

Automate vehicle detections in a point cloud using a pretrained PointPillars object detection network in the Lidar Labeler app. In this



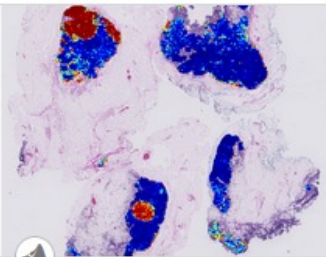
## Data Augmentations for Lidar Object Detection Using Deep Learning

Perform typical data augmentation techniques used in 3-D object detection workflows with lidar data.



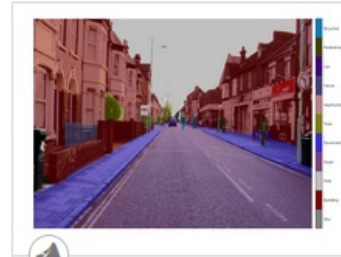
## Develop Raw Camera Processing Pipeline Using Deep Learning

Use a U-Net network to approximate a typical pipeline of image processing operations that convert raw camera data to an aesthetically



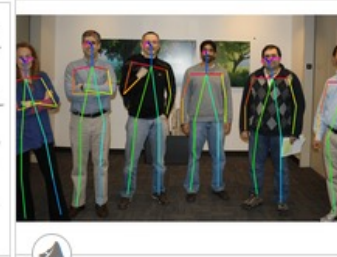
## Classify Large Multiresolution Images Using blockedImage and...

Classify multiresolution whole slide images (WSIs) that do not fit in memory using an Inception-v3 deep neural network.



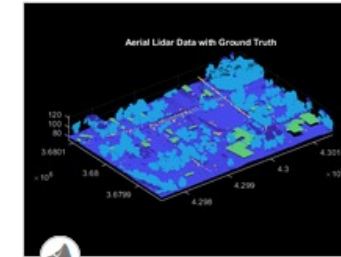
## Semantic Segmentation Using Deep Learning

Train a semantic segmentation network using deep learning.



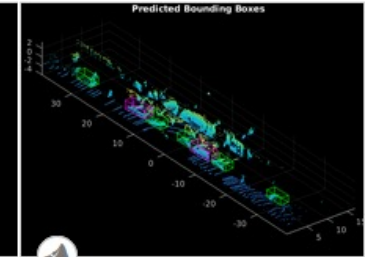
## Estimate Body Pose Using Deep Learning

Estimate the body pose of one or more people using the OpenPose algorithm.



## Terrain Classification for Aerial Lidar Data

Segment and classify terrain in aerial lidar data as ground, building, and vegetation. The example uses a LAZ file captured by an airborne lidar



## Lidar 3-D Object Detection Using PointPillars Deep Learning

Train a PointPillars network for object detection in point clouds.

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7월 7일	7월 14일	7월 21일	7월 22일	7월 28일
영상 분석을 위한 딥러닝	신호처리를 위한 머신러닝과 딥러닝	딥러닝 프로젝트를 위한 데이터 준비 기법	MATLAB Deep Learning Day 2021	MATLAB으로 시작하는 강화학습

딥러닝 부트캠프 응용편			
딥러닝 기반 이상탐지 기법	라이다 및 레이다를 위한 딥러닝	무선통신을 위한 딥러닝	바이오, 의료분야를 위한 딥러닝



<https://bit.ly/3hfSm24>  
오늘 등록하세요!



감사합니다