

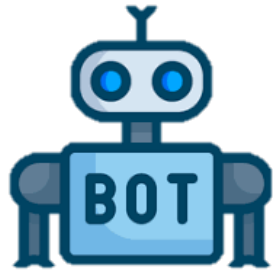
양로원 로봇

B팀

김준서
임승현
정종현
최지현

0

Recap



Robotics

Grab items

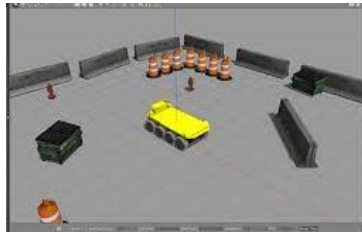
Get preset items to user
ex) medicine, paper cup

Stroll Assistant

Guidance for stroll around
ex) call admin, emergency detect
guide along preset path

Robot Service App for elderly people

via Simulation on GAZEBO 

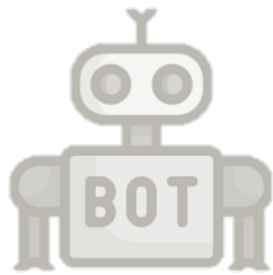


Web Application

User interact with robot

Admin manages robot

Call robot, view logs



Robot Service App for elderly people

via Simulation on GAZEBO 



Robotics

~~Grab items~~

Stroll Assistant

Guidance for stroll around
ex) call admin, ~~emergency detect~~
guide along preset path

Emergency detection via DL

Patrol around the map
Detect fall down human figure

Web Application

User interact with robot

Admin manages robot

Call robot, view logs

Stroll assistant

Guide along pre-set path

Speed control along user
via Object detection

Emergency detection

Emergency detection

Default mode

Patrols along the map

Detect fall down figure and
make alert

Pose detection Model

INDEX

1. Object Detection

2. Pose Detection

3. Gazebo

4. Weekly Plan

1

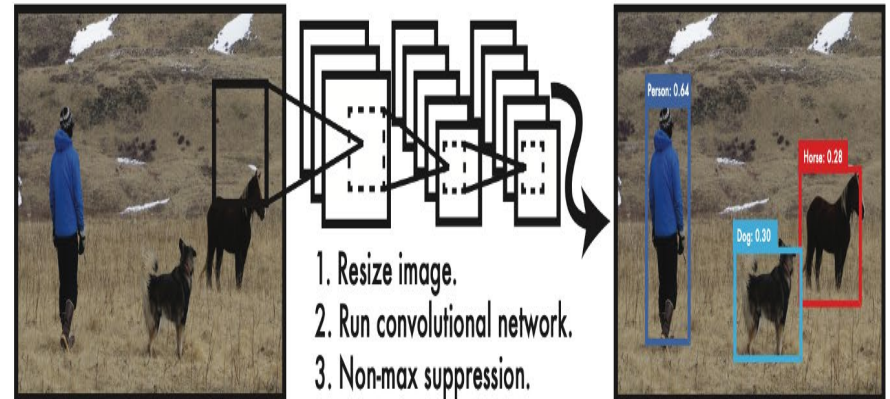
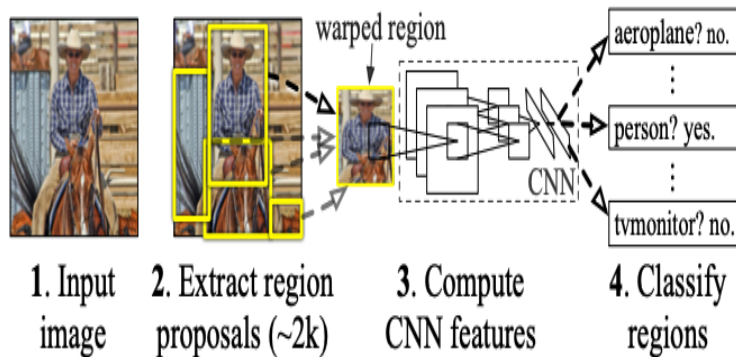
Object Detection

1 Object Detection

- R-CNN VS. YOLO

Object Detection Model

R-CNN: Regions with CNN features



1 Object Detection

- R-CNN VS. YOLO

Object Detection Model

	R-CNN	YOLO
Overall	Divide ROI(Regions of Interest) and CNN	Only Single CNN network
Speed	0.5FPS(Fast R-CNN)	45FPS
Precisi on	70.0%	63.4%

2

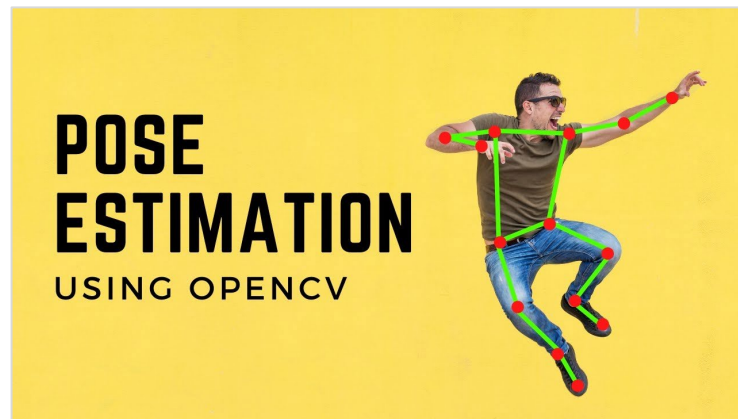
Pose Detection

2 Pose Detection

- Pose Estimation

Pose Estimation

Pose Estimation은 사람의 모습을 감지하는 컴퓨터 비전 기술



컴퓨터 비전에서 객체의 위치와 방향을 탐지하는 일반적인 문제
사람의 신체 관절인 keypoint가 어떻게 구성되어 있는지 위치를 측정, 추정

2 Pose Detection

- Realtime Multi-Person 2D Pose Estimation

Human Pose Estimation 접근 방식

Pose Estimation은 사람의 모습을 감지하는 컴퓨터 비전 기술

Top-Down 방식

사람을 먼저 감지를 한 다음
각 사람의 자세 추정함



사람 감지



자세 추정 X 사람수



Bottom-Up 방식

관절 부위(keypoint)를 먼저
감지하여 서로 연결해 모든
사람의 자세를 추정함



관절 부위 감지



관절 부위 이음



2 Pose Detection

- Realtime Multi-Person 2D Pose Estimation

Human Pose Estimation 접근 방식

Pose Estimation은 사람의 모습을 감지하는 컴퓨터 비전 기술

Top-Down 방식



문제점:

사람을 인식하지 못하면 측정할 수 없고
사람 수가 많아지면 계산량도 많아짐

Bottom-Up 방식



문제점:

찾은 관절을 매칭할 수 있는
조합이 많고 적절하게 매칭하는데
시간이 많이 걸림, 정확도 높이기 어려움

2 Pose Detection

- Realtime Multi-Person 2D Pose Estimation

Realtime Multi-Person 2D Pose Estimation

Realtime Multi-Person 2D Pose Estimation using Part Affinity Fields *

Zhe Cao Tomas Simon Shih-En Wei Yaser Sheikh
The Robotics Institute, Carnegie Mellon University
{zhcao, shihenw}@cmu.edu {tsimon, yaser}@cs.cmu.edu

Abstract

We present an approach to efficiently detect the 2D pose of multiple people in an image. The approach uses a non-parametric representation, which we refer to as Part Affinity Fields (PAFs), to learn to associate body parts with individuals in the image. The architecture encodes global context, allowing a greedy bottom-up parsing step that maintains high accuracy while achieving realtime performance, irrespective of the number of people in the image. The architecture is designed to jointly learn part locations and their association via two branches of the same sequential prediction process. Our method placed first in the inaugural COCO 2016 keypoints challenge, and significantly exceeds the previous state-of-the-art result on the MPII Multi-Person benchmark, both in performance and efficiency.



Figure 1. **Top:** Multi-person pose estimation. Body parts belonging to the same person are linked. **Bottom left:** Part Affinity Fields (PAFs) corresponding to the limb connecting right elbow and right wrist. The color encodes orientation. **Bottom right:** A zoomed in view of the predicted PAFs. At each pixel in the field, a 2D vector encodes the position and orientation of the limbs.

2 Pose Detection

- Realtime Multi-Person 2D Pose Estimation

Realtime Multi-Person 2D Pose Estimation

Bottom up

정확도가 떨어지거나 조합 증가에 따른 계산량의 증가 등의 문제
신체 부위 사이의 중간점을 따내는 등 위치 정보를 추가하는 기법 제안 존재,
그러나 방향 정보 없이는 표현에 한계

논문 방식

신체 부위의 위치, 신체 부위 간의 연결도 인코딩
위치 정보, 방향 정보를 포함하는 표현을 limb(신체 부위의 이름 맞춤 부분)
를 2D 벡터로 인코딩할 수 있는 필터를 학습

2 Pose Detection

- Realtime Multi-Person 2D Pose Estimation

Realtime Multi-Person 2D Pose Estimation

Bottom up

정확도가 떨어지거나 조합 증가에 따른 계산량의 증가 등의 문제
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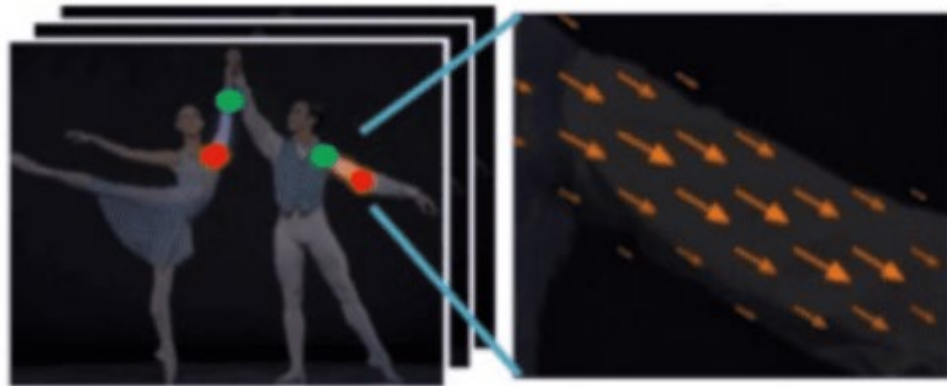
2 Pose Detection

- Realtime Multi-Person 2D Pose Estimation

Realtime Multi-Person 2D Pose Estimation

사람을 감지하고 각 사람에 각각 pose estimation을 수행하는 Top-Down 방식 대신 관절을 먼저 찾아 여러 사람의 pose estimation을 수행하는 **Bottom-Up 접근으로도 pose estimation의 정확성과 속도를 개선 가능**

정확도가 떨어지거나 조합 증가에 따른 계산량의 증가 등의 문제



채널마다 각 신체 부위 사이의 흐름을 인코딩(그림은 2명의 왼쪽 팔의 흐름)을 나타냄

3

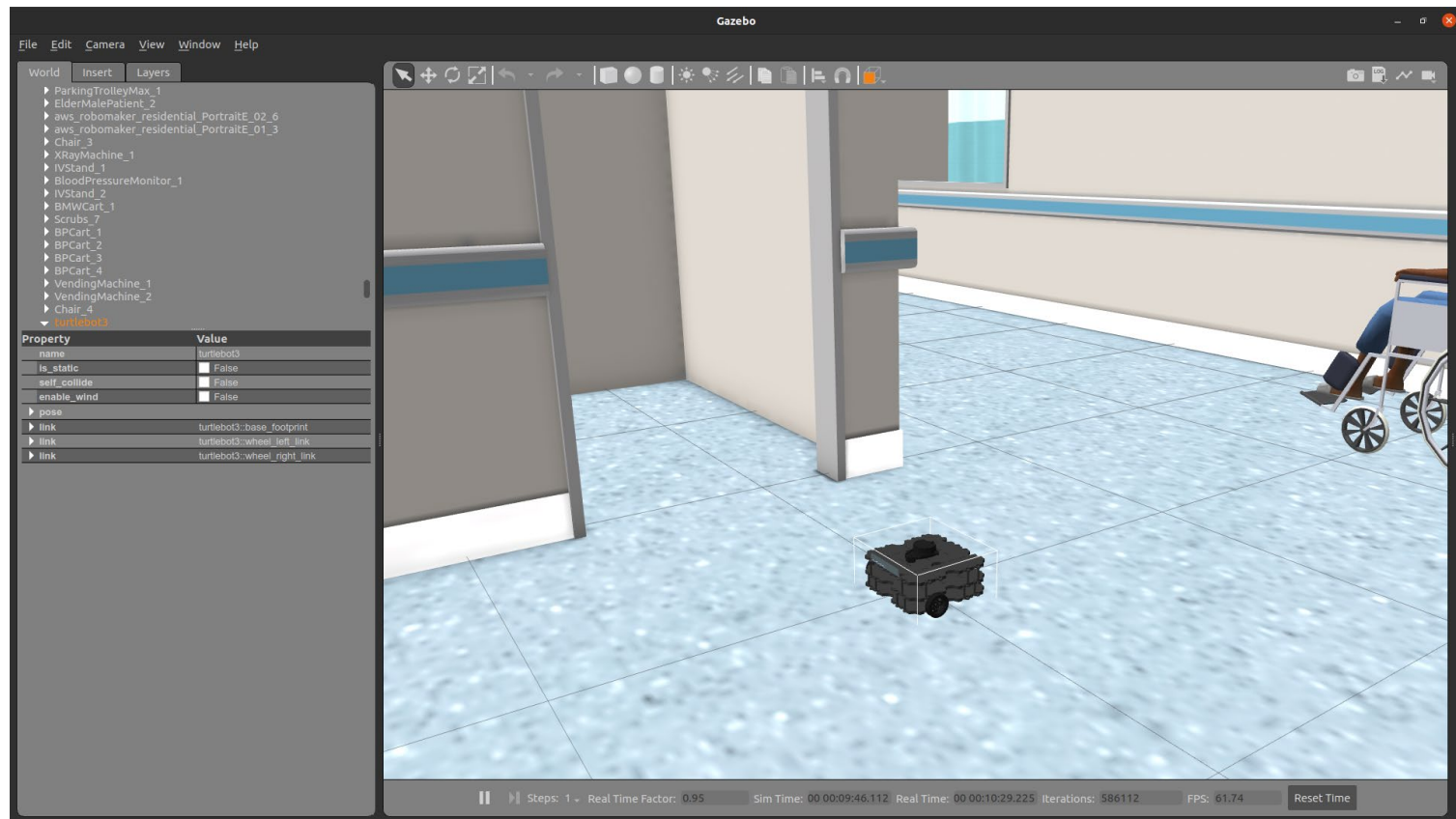
Gazebo

3 Gazebo

- What is Gazebo?

Gazebo?

Gazebo: 3D dynamic simulator

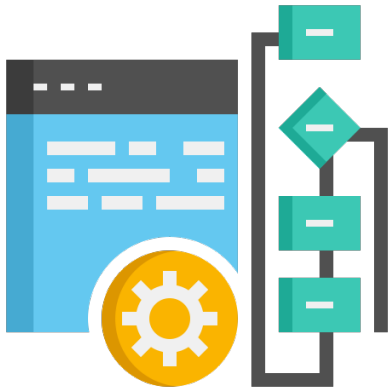


3 Gazebo

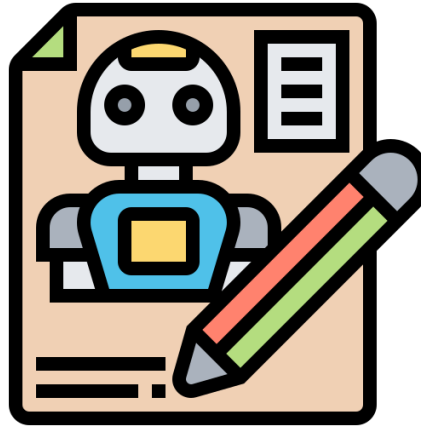
- What is Gazebo?

Gazebo?

Gazebo: Usage



Testing robotics algorithm



Designing robot



Performing regression testing
with realistic scenarios

3 Gazebo

- What is Gazebo?

Gazebo?

Gazebo: Advantage

1. ROS Integration



3 Gazebo

- What is Gazebo?

Gazebo?

Gazebo: Advantage

2. Supported Sensors

Simulator	Supported Sensors
Gazebo	Camera Sensor, Depth camera sensor, Distance and Proximity Sensors, Laser, Force Sensors
V-Rep	Vision Sensor, Force Sensor, Proximity Sensor, Accelerometers Gyro, Lasers, Lidars
Unity	Cameras

3 Gazebo

- What is Gazebo?

Gazebo?

Gazebo: Advantage

3. Compatability

TABLE III
CAPABILITY OF IMPORTING/EXPORTING URDF AND SDF.

	Import		Export	
	SDF	URDF	SDF	URDF
V-Rep	Yes	Yes	No	No
Unity	No	Yes	No	Yes
Gazebo	Yes	Yes	Yes	No

3 Gazebo

- What is Gazebo?

Gazebo?

Gazebo: Advantage

4. License

Simulator	License
Gazebo	Apache 2.0 (Open-source)
V-Rep	GNU(Free for Education)
Unity	Free for student

3 about ROS

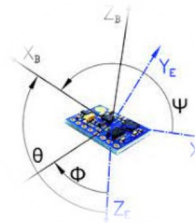
- How Do We Operate Robot in Simulator?

How Do We Operate Robot in Simulator?

Gazebo
Simulator

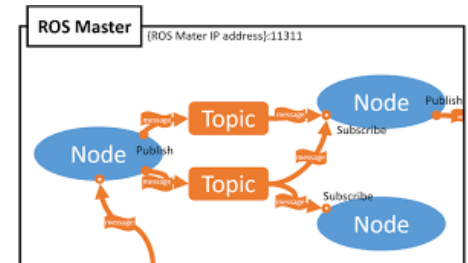


Robot Sensors



ROS

ROS #



ROS is necessary for easy development!

3 about ROS

- How Do We Operate Robot in Simulator?

How Do We Operate Robot in Simulator?

Why ROS?

Gazebo
Simulator



Robot Sensors

ROS

Connect all nodes through TCP Connections
Easy to control overall framework!

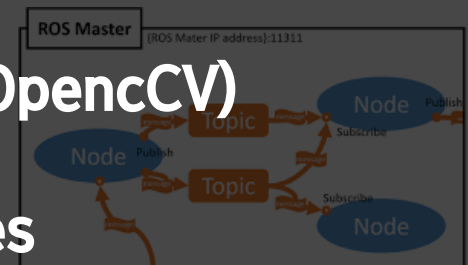
ROS #



Provide functional tools (Gazebo, Opencv)

Many Open source packages

(For Robot Navigation, Mapping, Control, Sensor data collection...)

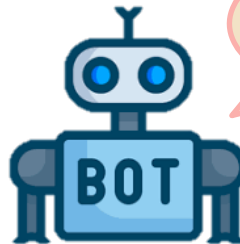
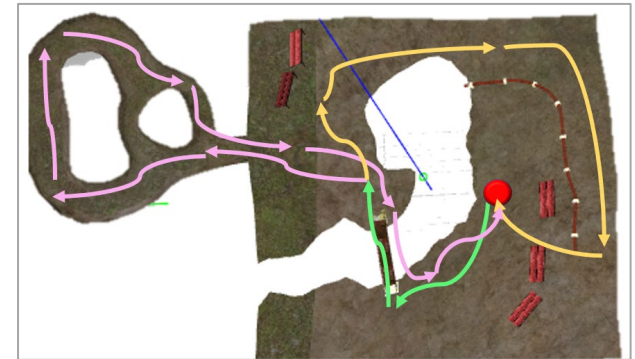
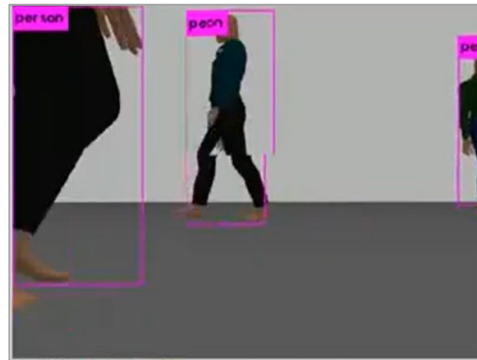
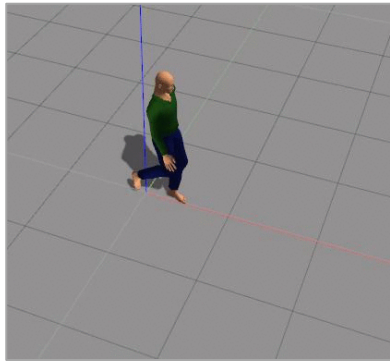


ROS is necessary for easy development!

3 Simulation

- Taking a Walk with Emergency Inspection

Taking a walk with Emergency inspection



Elderly out of
sight!
Emergency!

Emergency Sign



4

Weekly Plan

4 Weekly Plan



	Week6	Week7	Week8	Week9	Week 10 presentation	Week11	Week12	Week13	Week14	Week 15 final presentation
Robotics	Setting on Gazebo	Add user model	Navigation Stockport Edit robot model	Set Navigation Stack parameter			Check navigation function	Test and trouble shooting		
DL			Train model							
Frontend	Build app for user	Build app for user	Login feature	Connect with robot		Emergency alert message	Build app for admin			
Backend		Design Database	set API for emergency	Connect robot with app		Set API for command log				
Document	Proposal document							Final document		

로보틱스 – 임승현 정종현
 DL – 김준서 최지현
 프론트 – 최지현 김준서
 백엔드 – 김준서 정종현



THANK YOU

