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# CP341 – Topics In CS

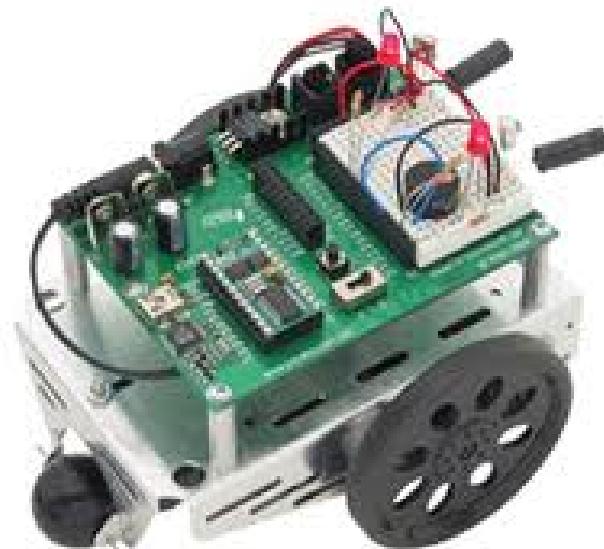
## Robotics and Computer Vision

# Introduction

[cs.coloradocollege.edu/~mwhitehead](http://cs.coloradocollege.edu/~mwhitehead)

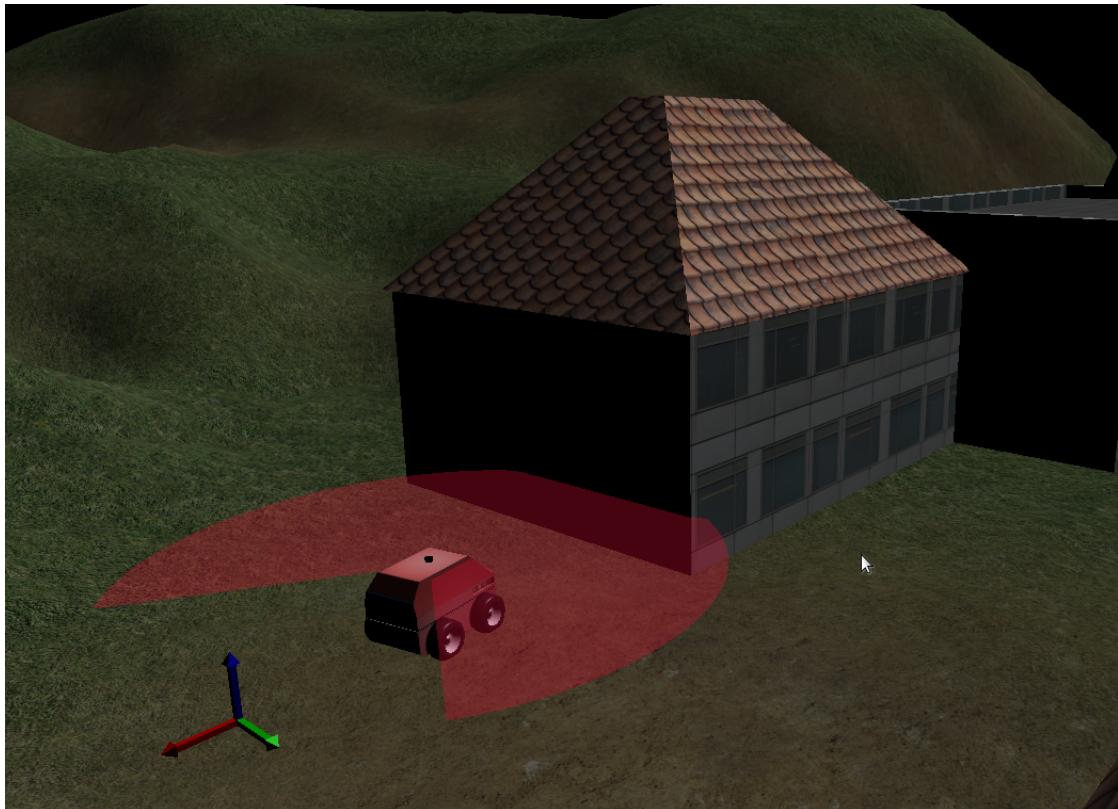
# Class Goals

## #1 Build a Small Robot



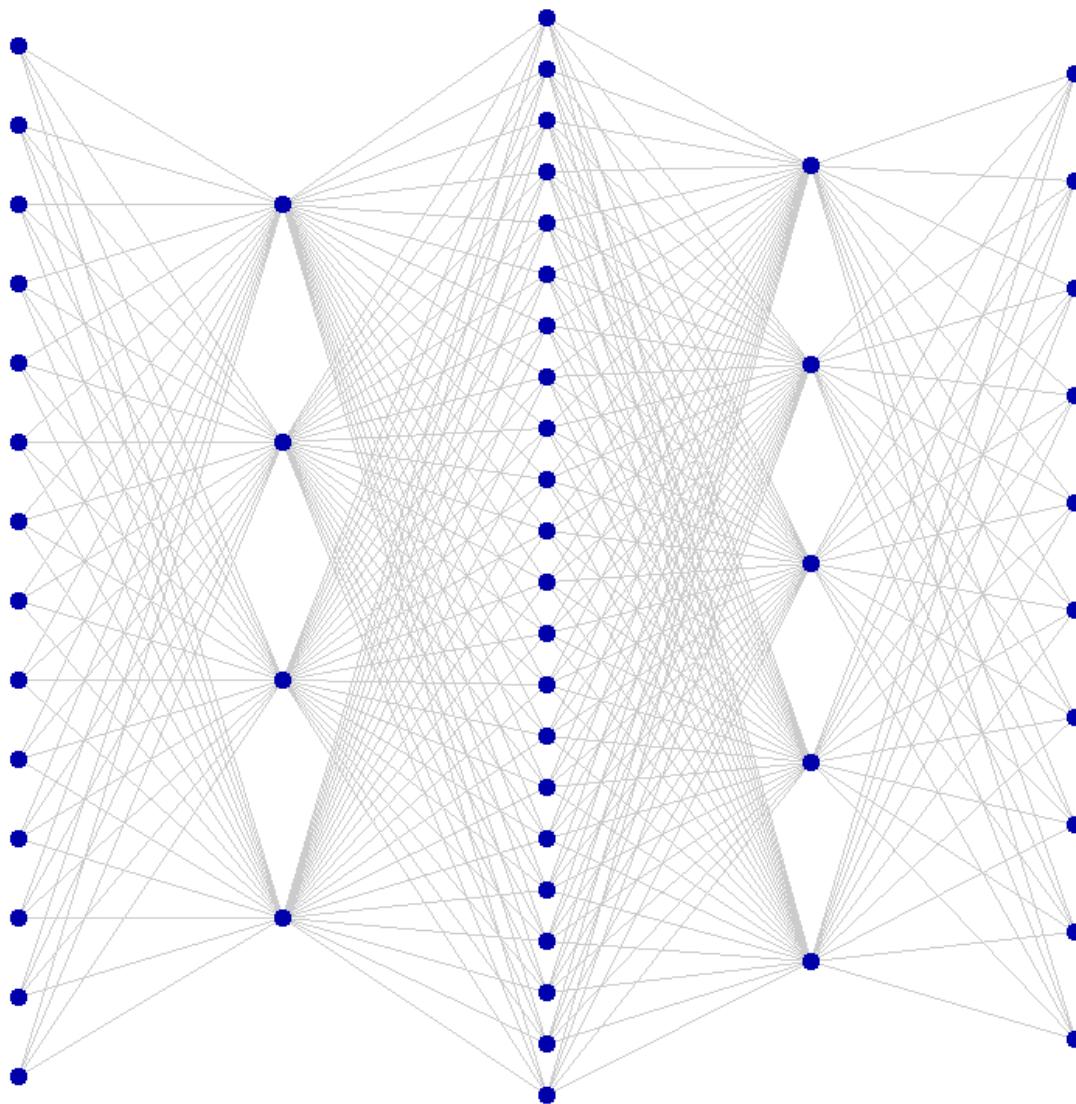
# Class Goals

## #2 Work with a Robotics Simulator



# Class Goals

## #3 Build Neural Networks



# Class Goals

## #4 Complete a Larger Project



# Current Robotics



# Current Robotics



# Current Robotics



# Current Robotics



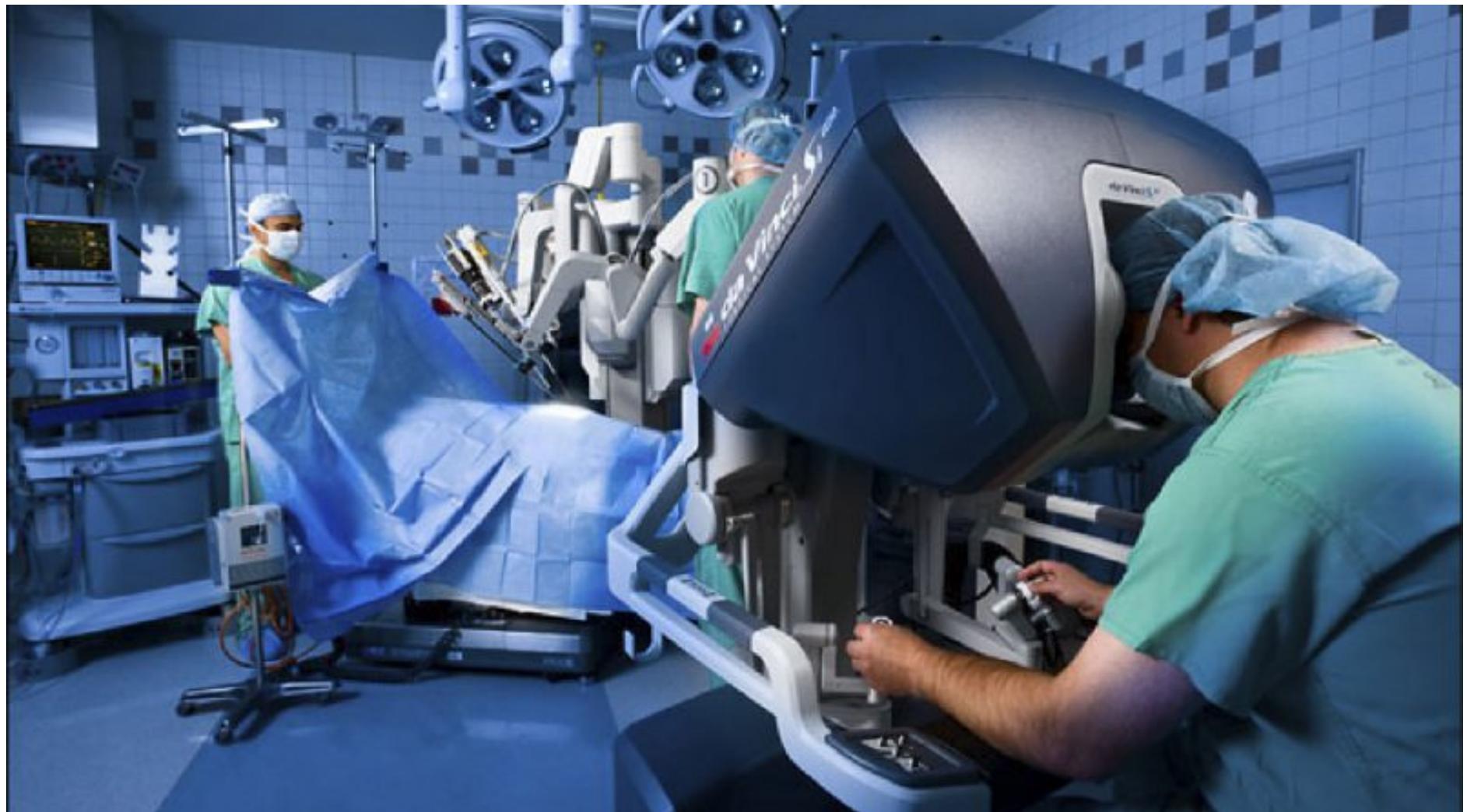
# Current Robotics



# Current Robotics



# Current Robotics



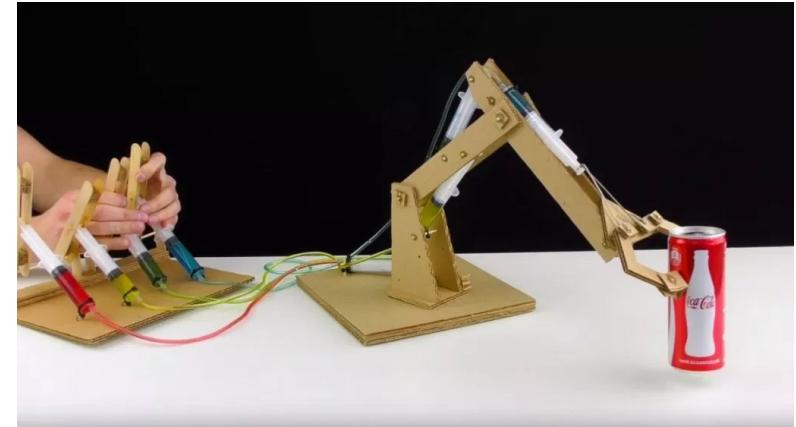
# Exercise

Cut out a 2D cardboard robot arm with two segments connected with a tack

Define the set of 2D points that can be reached by the end tip of the arm

Are there multiple ways to reach a single point?

Attach a piece of chalk to the end of the arm and use it to write your name on the chalkboard

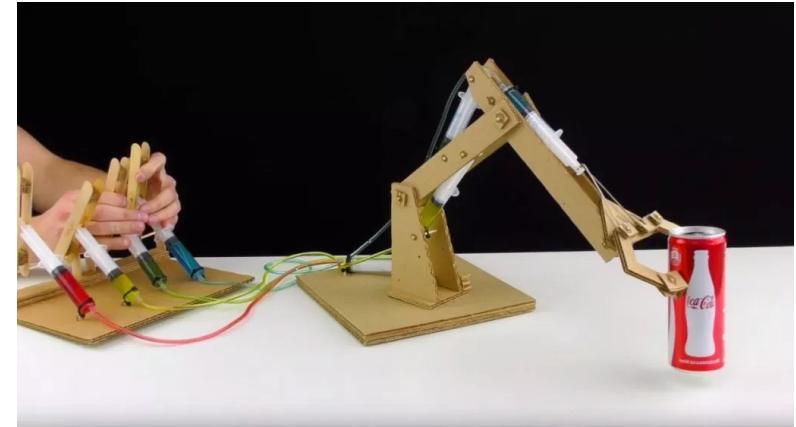


<https://youtu.be/P2r9U4wkjcc>

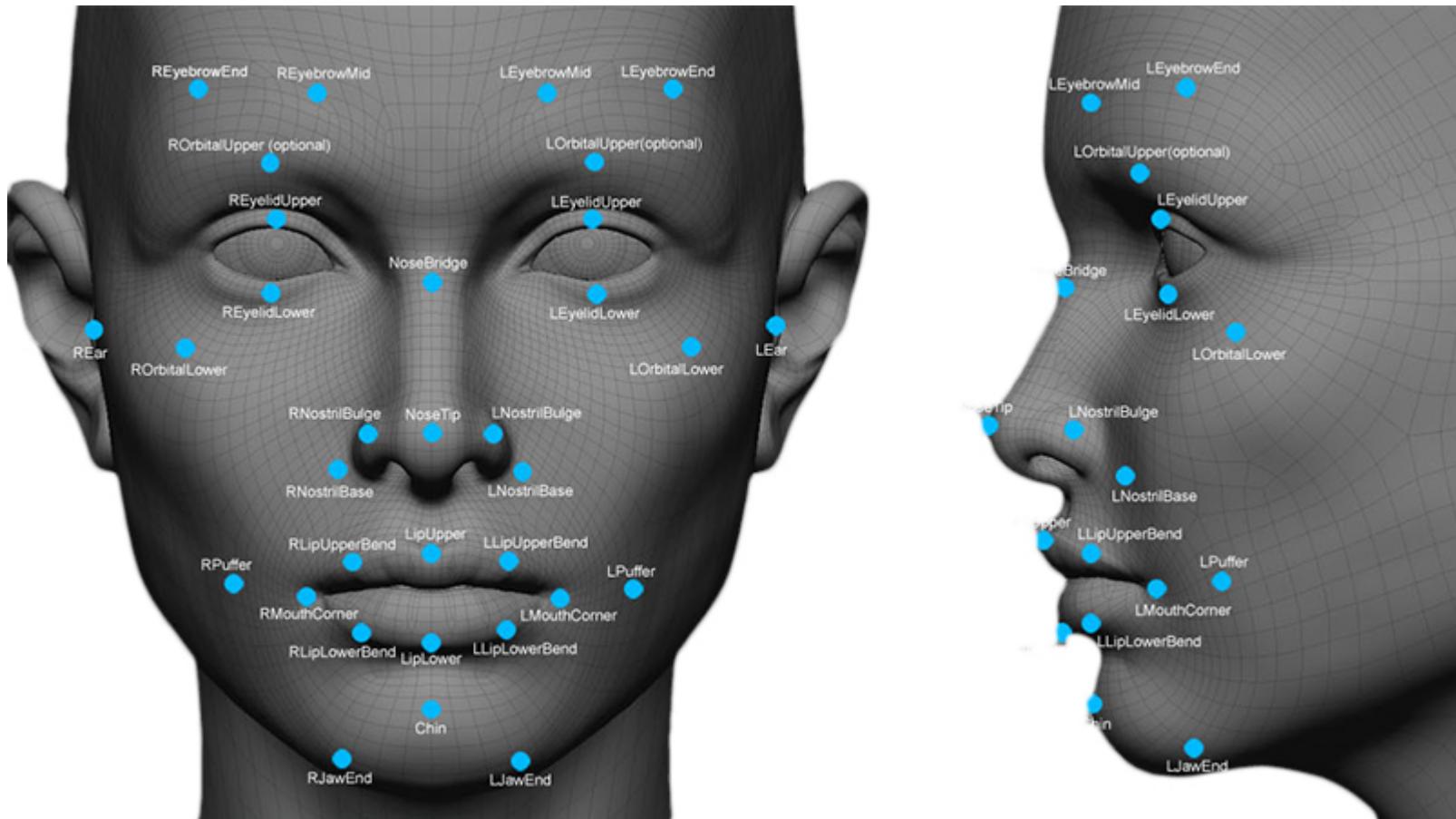
# Exercise

Suppose your first arm segment were positioned vertically on a rotating base.

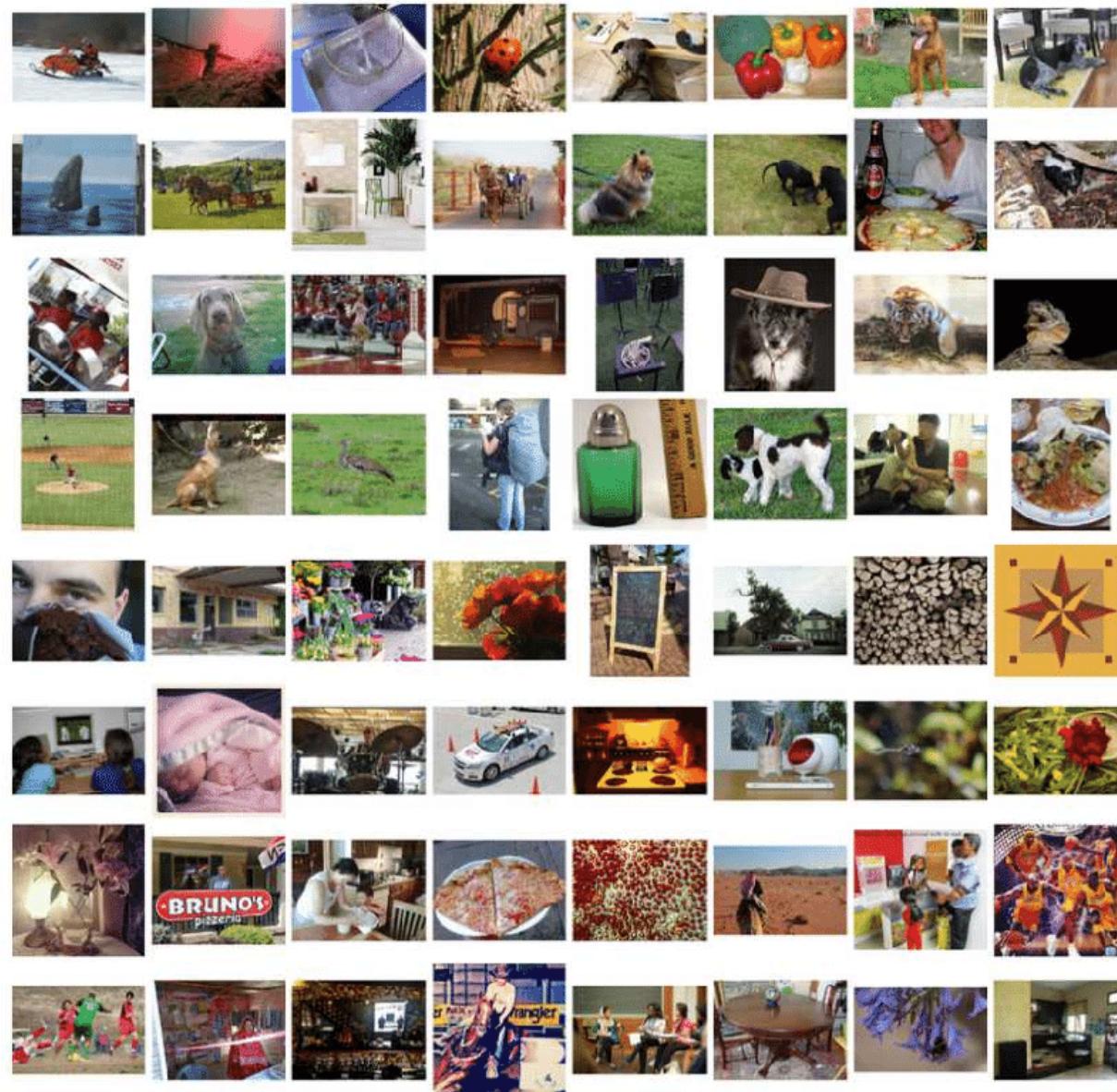
Define the set of 3D points that can be reached by the end tip of the arm



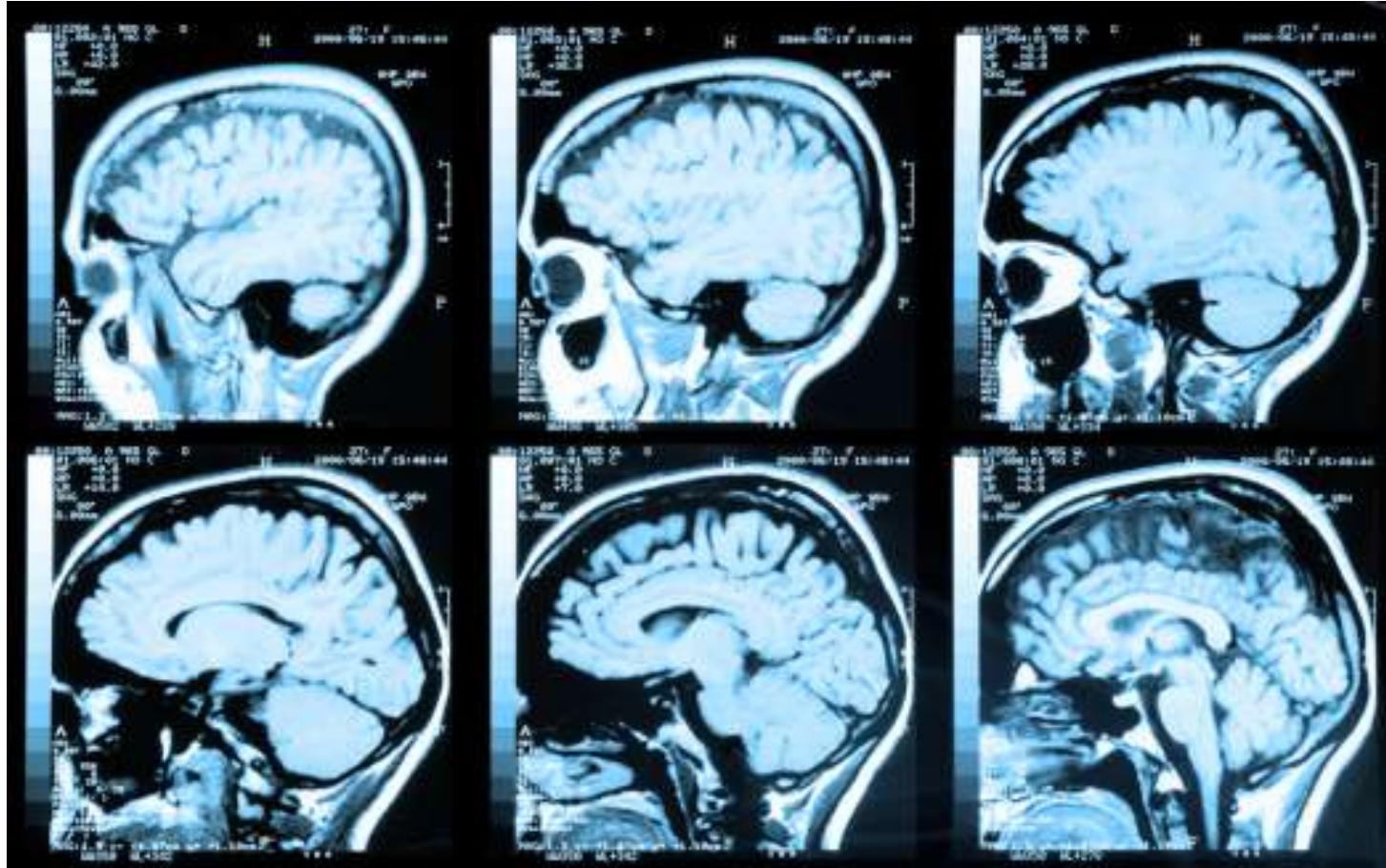
# Current Computer Vision



# Current Computer Vision



# Current Computer Vision



# Current Computer Vision



# Current Computer Vision



# Current Computer Vision



# VirtualBox



Oracle VM VirtualBox Manager

File Machine Help

Tools

New Settings Discard Start

Icon	Name	Status
Windows 10 S Real	Windows 10 S Real	Powered Off
w8.1	w8.1	Powered Off
windows 10 test	windows 10 test	Powered Off
Linux Mint	Linux Mint	Powered Off
Debian	Debian	Powered Off

General

Name: Debian  
Operating System: Debian (64-bit)  
Settings File Location: C:\Users\Martin\VirtualBox VMs\Debian

System

Base Memory: 8192 MB  
Boot Order: Floppy, Optical, Hard Disk  
Acceleration: VT-x/AMD-V, Nested Paging, KVM Paravirtualization

Display

Video Memory: 16 MB  
Graphics Controller: VBoxVGA  
Remote Desktop Server: Disabled  
Recording: Disabled

Storage

Controller: IDE  
IDE Secondary Master: [Optical Drive] Empty  
Controller: SATA  
SATA Port 0: Debian.vdi (Normal, 32.00 GB)

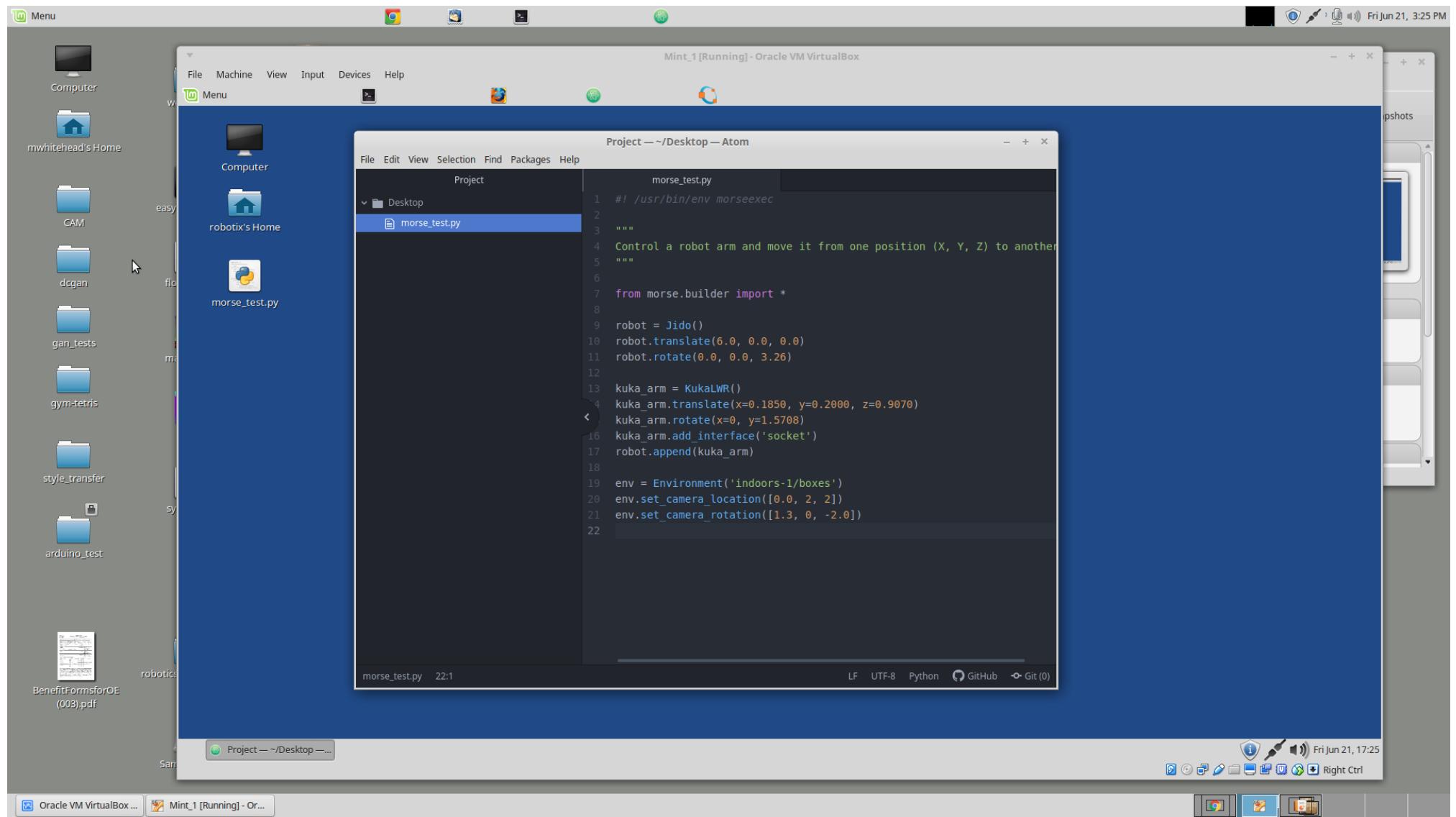
Audio

Host Driver: Windows DirectSound  
Controller: ICH AC97

Preview



# Pre-Loaded Linux Mint Image



# Exercise – Detect Basketball

```
from PIL import Image  
  
im = Image.open("bball.jpg")  
  
...  
  
# Access a single pixel  
# at position (20, 40)  
# and returns a tuple  
print im.getpixel((20, 40))
```



# Robots making moral decisions?

