

3D depth camera's

In this book you can find different sources and tutorials concerning the use of 3D depth camera's like Kinect (360, v1 and v2), Azure, Intel RealSense and iPad Pro with lidar combined with creative software.

These devices include infrared depth sensing camera's, RGB color camera's & microphones. The SDK enables features such as skeleton tracking, hand interactions, point clouds and voice recognition. Each sensor has different specs.

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Types of Depth camera's & alternatives for position tracking

At HKU we have most of these camera's available. Inform about the possibilities at the Blackbox



kinect 360

Kinect on Mac

Kinect on Pc



Kinect One

Kinect on Mac

Kinect on Pc



Kinect Azure

Kinect on Mac

Kinect on Pc



Realsense



**Orbec Astra
plugin for Touchdesigner**



zed 2i

Camera for depth perception, motion and AI, the ZED 2i is a durable and versatile stereo camera that can be deployed in most environments. (also outside!)

Zed in Touchdesigner



Orbec Femto Bolt & Mega



Oak D

Spatial AI camera (open source) OAK stands for OpenCV AI Kit. PC & Mac compatible, python setup necessary! For loan @ BB Jk

[Touchdesigner setup](#)

[Data sheet](#)



Leap motion 1



Leap motion 2



Hokuyo

The URG-04LX-UG01 scanning laser rangefinder is a low power, small, accurate, high-speed device for obstacle detection. Using the USB interface for power and communication, this unit can obtain measurement data in a 240° field of view up to a distance of 4 meters.

download driver (link)

<https://www.hokuyo-aut.jp/products/data.php?id=2>

Touchdesigner has a chop for it, the Hokuyo will work when connected, in mac

Some comparison articles:

<https://www.generationrobots.com/blog/en/luxonis-vs-realsense-which-depth-camera-should-i-choose/>

https://docs.ipisoft.com/Depth_Sensors_Comparison

the 3 kinects compared: <https://www.mdpi.com/1424-8220/21/2/413>

https://www.youtube.com/embed/KRZWev1N_uw

depth maps compared

https://www.youtube.com/embed/tqb_0xAqm3w

Apps that can do body tracking for your mobile devices

<p>ZIGSimPro an app that turns your phone/tablet into a depth sensor & tracking camera (over OSC)</p>	<p>iKeleton OSC an app that turns your phone into body tracking camera (over OSC) sending X&Y coordinates</p>	<p>Media Pipe* MediaPipe is a cross platform Framework for building machine learning pipelines for processing time-series data like video, audio, etc. Amongst many other possibilities it turns your webcam into a depth/tracking camera.</p>
<p>Mocap: optitrack TBD</p>	<p>Mocap: Vive 2x TBD Vive trackers Vive Ultimate trrackers</p>	

Kinect on Mac

Kinect 360 & Kinect One works on Mac with Isadora
Allow a warmup time of 30-60 minutes for stable results.

Kinect on Mac

Kinect + Processing > Mac (M1 Monterey & Ventura)

Kinect processing MAC M1, **works on Monterey & Ventura**

First install Rosetta:

<https://osxdaily.com/2020/12/04/how-install-rosetta-2-apple-silicon-mac/>

Get the libraries for processing:

<https://github.com/shiffman/OpenKinect-for-Processing>

<https://shiffman.net/p5/kinect/> (dead link)

<https://github.com/shiffman/OpenKinect-for-Processing/releases>

Open standard library to test:

File > examples > contributed libraries. Open kinect for processing > V1 , then Run code

“ Do you get the error: NoClassDefFoundError: /com/sun/jna/Library ?

Fix: <https://discourse.processing.org/t/processing-4-openkinect/32781/9>

Example codes

Warning: the code for kinect 1 and 2 is not the same..

check: <https://shiffman.net/p5/kinect/> (dead link)

> Examples

Tutorials for using Kinect data in Processing:

Check out the Coding Train videos series: Introduction to Computer vision, chapter 12.1 (What is the Kinect?): <https://www.youtube.com/watch?v=QmVNgdapJJM>

Link to the entire series: https://www.youtube.com/watch?v=h8tk0hmWB44&list=PLRqwX-V7Uu6aG2RJHErXKSWFDXU4qo_ro

Kinect on Mac

Kinect in Isadora (Mac)

To use Kinect in Isadora you need to download a couple of plugins from the Troikatronix page;

<https://troikatronix.com/add-ons/openni-tracker/>

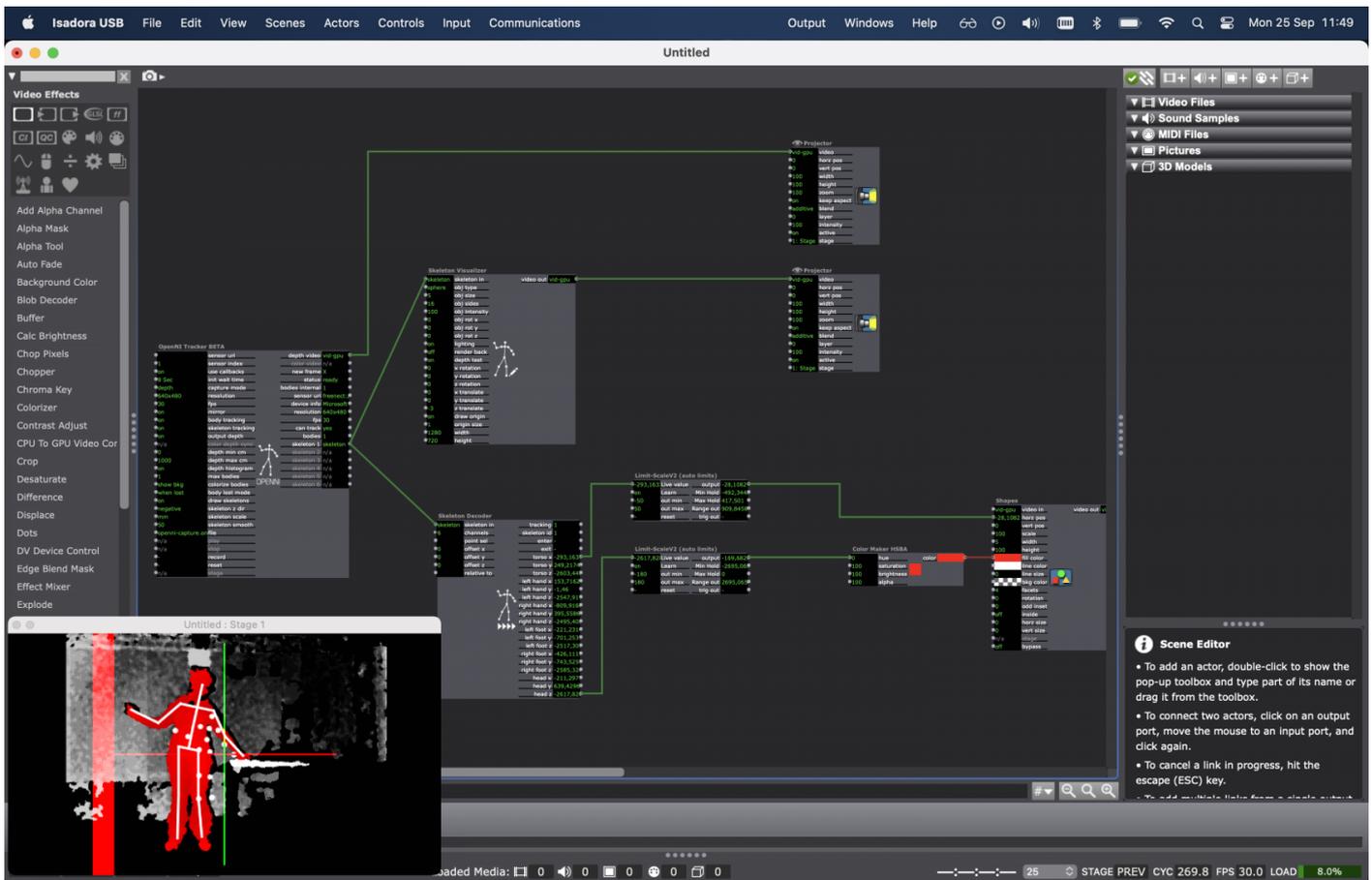
Read the instruction with attention & follow them.

Kinect 360 works on Mac air & Mac pro (M1 with Rosetta)

Kinect V1 works on Mac pro (M1 with Rosetta)

Connect your Kinect before starting Isadora.

Add the nodes in the picture below (or open the patch shared in [nextcloud](#))



If your Kinect is not recognised by the software, try resetting or deleting the OpenNItracker or even adding it again.

Detailed explanation of the possibilities with Kinect in Isadora can be found here:

<https://troikatronix.com/add-ons/tutorial-openni-tracker/>

and here:

<https://www.youtube.com/embed/-fdsNW03TP4>

Kinect on Mac

Setup & Lighting

How you setup your Kinect matters a lot for your performance. Think about placement, light & what you are wearing.

Read up on those specs here: [Setup & lighting tips for kinect](#)

Kinect on PC

Kinect works on PC in various types of software.

Install drivers first! Make sure to select the right driver & only install one driver at a time to avoid problems. Allow a warmup time of 30-60 minutes for stable results.

Drivers

Check out this dudes tutorial:

<https://www.youtube.com/embed/u1AzY4OxzQM>

- Select the right type of driver for your kinect.
- Download & install as instructed on the pages below
- tip: only install one type of kinect a time on your pc, as things may get messy after mixing.

Kinect 360 (SDK 1.8)

- Install the [Kinect Runtime 1.8](#) or [Kinect for Windows SDK 1.8](#) from Microsoft.



This sensor is widely available on '[marktplaats](#)' & doesn't cost much. Don't forget to also purchase a dedicated [Kinect power/USB cable](#) to connect it to your computer!

Kinect One (SDK 2.0)

- Install the [Kinect SDK 2.0](#) from Microsoft.
and [Runtime 2.0](#)



Kinect Azure

You can find installation details for Azure Kinect Sensor SDK and Firmware [here](#).



TIPS FOR WORKING WITH ALL KINECT SENSORS

- Always connect the AC power supply that comes with the Kinect sensor. The green LED will light up under USB power, however the sensor will not function correctly unless the AC power supply is also connected.
- Kinect V1 can be less stable on USB3.0 ports, try USB2.0 ports if you are experiencing problems connecting to the device or the connection drops out after some time.
- If using multiple Kinects, each Kinect sensor must be connected to its own USB controller. On some computers multiple USB ports will be on the same USB controller, this will cause problems if two Kinects are sharing that same controller. Refer to your computer's Device Manager to inspect which ports belong to each USB controller.

- remember: you need the correct driver for the kinect you are using. Uninstall the drivers you are NOT using, when switching Kinect type. [How to Uninstall here](#)

Kinect In Touchdesigner

Using any Kinect in Touchdesigner on PC is plug & play after you've installed the right [drivers](#) & SDK.

Ways to interface with Kinect in TouchDesigner

- Depth camera - [Kinect TOP](#)
- RGB camera - [Kinect TOP](#)
- Infrared camera - [Kinect TOP](#)
- Skeleton Point Tracking - [Kinect CHOP](#)
- Hand Interaction - [Kinect CHOP](#)
- Microphone Array Audio Capture - [Audio Device In CHOP](#)
- To control the tilt of the camera, use the Tscript `kinecttilt` Command

The **Kinect Azure** has the above but use specific operators that work together:

- [Kinect Azure TOP](#)
- [Kinect Azure Select TOP](#)
- Skeleton Point Tracking - [Kinect Azure CHOP](#) **NOTE:** For joint orientation and bone hierarchy, see: [Kinect Hierarchy](#)

The Pallette has this interesting component: [Kinect Calibration for Projection Mapping](#) which allows for calculating the intrinsics and extrinsics of a projector in relation to a Kinect device making it possible to project onto the scene captured by the kinect.

Check out the specifics, possibilities and some example patches on the derivative site:

<https://derivative.ca/UserGuide/Kinect1> for Kinect 360

<https://derivative.ca/UserGuide/Kinect> for Kinect One

or [Kinect Azure](#) in the search bar

Kinect in Isadora

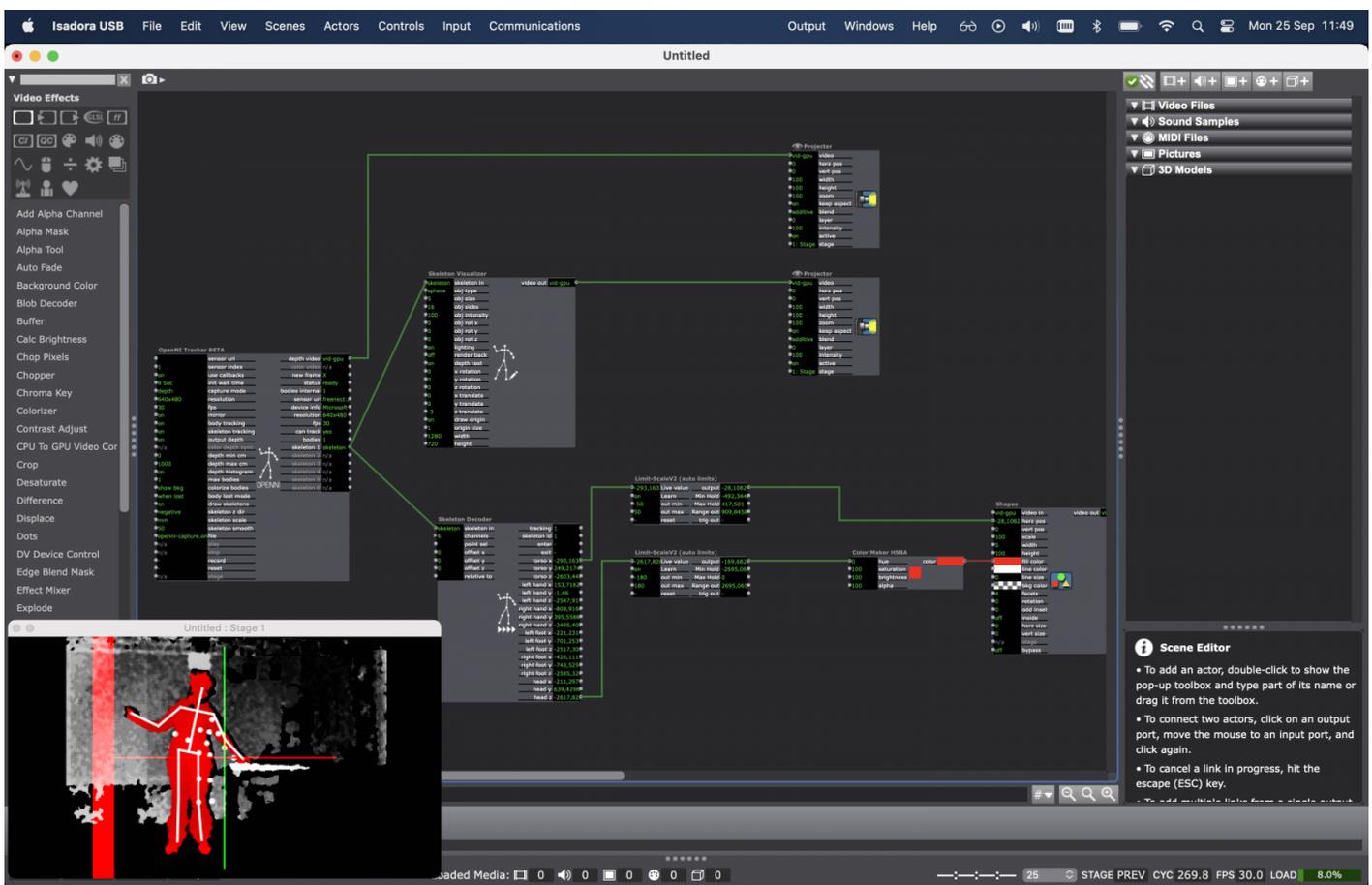
To use Kinect in Isadora you need to download a couple of plugins from the Troikatronix page;

<https://troikatronix.com/add-ons/openni-tracker/>

Read the instruction with attention & follow them.

Connect your Kinect before starting Isadora.

Add the nodes in the picture below (or open the patch shared in [nextcloud](#))



If your Kinect is not recognised by the software, try resetting or deleting the OpenNItracker or even adding it again.

Detailed explanation of the possibilities with Kinect in Isadora can be found here:

<https://troikatronix.com/add-ons/tutorial-openni-tracker/>

and here:

<https://www.youtube.com/embed/-fdsNW03TP4>

Issues:

- If you followed all the steps and read the info for your operating system and the Kinect still doesn't work it might be that the issues can be (on PC) that the plugins are installed in the wrong place.

Go to Isadora > help > open plugin folder > TroikaTronix actor Plugins

you should see the plugins here: OpenNI tracker, Skeleton Decoder, Skeleton Visualiser.

If you don't see them check the folder : Plugins. If they are installed in this folder copy them to the directory above (TroikaTronix actor Plugins)

You might need to restart Isadora.

Kinect on PC

Setup & Lighting

How you setup your Kinect matters a lot for your performance. Think about placement, light & what you are wearing.

Read up on those specs here: [Setup & lighting tips for kinect](#)

Mediapipe

MediaPipe is a cross platform Framework for building machine learning pipelines for processing time-series data like video, audio, etc. Amongst many other possibilities it turns your webcam into a depth/tracking camera.

Full documentation can be found here <https://developers.google.com/mediapipe/>

There are various ways to get Mediapipe set up in your computer;

When using Touchdesigner, have a look [HERE](#)

But also, be sure to check out [Gazebo](#), a HKU built OSC tool, that also runs Mediapipe.

Oak D

Unleash Your Creativity with Oak-D and TouchDesigner

1. Introduction
2. Overview of the Oak-D AI Powered Camera
3. Understanding Depth AI and its Applications 3.1 Media Pipe Hand Tracking 3.2 YOLO Object Recognition Model 3.3 Gaze Estimation 3.4 Segmentation 3.5 Text Detection
4. Comparing Oak-D with Other Cameras in the Market 4.1 Azure Camera 4.2 Pros and Cons of Oak-D
5. Setting Up the Necessary Libraries 5.1 Installing Python and Required Libraries 5.2 Using PyCharm as the Integrated Development Environment 5.3 Working with Virtual Environments
6. Exploring the Depth AI Examples 6.1 Understanding the Color Camera and RGB Video Example 6.2 Exploring the Stereo Depth Example
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The Oak-D AI Powered Camera: A Game Changer in Computer Vision

Artificial Intelligence (AI) is revolutionizing various fields, and one area where it is making significant advancements is computer vision. In this article, we will delve into the world of the Oak-D AI powered camera. We will explore its features, applications, and advantages over other cameras in the market. Moreover, we will guide you through the process of setting up the necessary libraries and provide an overview of the depth AI examples.

1. Introduction

AI has become a game changer in various industries, and computer vision is one domain where its impact is transformative. The Oak-D AI powered camera is a remarkable innovation in the world of computer vision. Equipped with stereo and mono cameras, as well as an RGB camera, the Oak-D camera is capable of running various AI models. In this article, we will explore the capabilities of the Oak-D camera and guide you through the process of getting it up and running.

2. Overview of the Oak-D AI Powered Camera

The Oak-D camera, developed by Luxonis, is an AI powered camera that combines hardware and software to enable advanced computer vision applications. It consists of stereo and mono cameras on the sides, along with an RGB camera in the middle. This configuration allows the camera to capture depth and color information simultaneously. Additionally, the Oak-D camera can load and run various AI models, making it versatile and suitable for a wide range of applications.

3. Understanding Depth AI and its Applications

Depth AI is the Spatial AI platform that is embedded in the Oak-D camera. It is responsible for processing the captured data and running the AI models. The Oak-D camera supports numerous AI models that enable applications such as media pipe HAND tracking, YOLO object recognition, gaze estimation, segmentation, and text detection.

3.1 Media Pipe Hand Tracking

One of the key applications of the Oak-D camera is media pipe hand tracking. This AI model allows the camera to track and recognise hand movements in real time. It has extensive applications in fields such as robotics and engineering, and is gaining popularity in the art and tech communities.

3.2 YOLO Object Recognition Model

The Oak-D camera is also capable of running the YOLO (You Only Look Once) object recognition model. This model enables real-time object detection and recognition, providing accurate and fast results. It has applications in fields such as surveillance, autonomous vehicles, and augmented reality.

3.3 Gaze Estimation

Another powerful feature of the Oak-D camera is the ability to estimate gaze direction. This AI model can accurately determine where a person is looking, enabling applications such as eye tracking, Attention analysis, and user interaction in various domains.

3.4 Segmentation

The Oak-D camera can also perform image segmentation, which involves separating an image into different regions or objects. This enables precise object identification and tracking, with applications in areas such as medical imaging, scene understanding, and image editing.

3.5 Text Detection

Text detection is another AI model that the Oak-D camera can handle effectively. It can identify and extract text from images, enabling applications such as optical character recognition (OCR), document analysis, and text-to-speech conversion.

4. Comparing Oak-D with Other Cameras in the Market

When exploring AI powered cameras, it is essential to consider the available options. One popular camera in the market is the Azure Camera. However, the Oak-D camera offers several advantages over the Azure Camera.

4.1 Azure Camera

The Azure Camera is a well-known AI powered camera in the market. While it offers impressive features, it falls short in certain areas compared to the Oak-D camera. Firstly, the Oak-D camera is more affordable, making it an attractive option for various applications. Additionally, the Oak-D camera has the ability to load and run multiple AI models, providing greater flexibility compared to the limited options of the Azure Camera.

4.2 Pros and Cons of Oak-D

Pros:

- **Affordability:** The Oak-D camera offers a cost-effective solution for AI powered computer vision applications.
- **Versatility:** With the ability to load and run multiple AI models, the Oak-D camera caters to a wide range of applications.
- **Depth Sensing:** The stereo and mono cameras of the Oak-D camera enable accurate depth sensing in well-lit environments.

Cons:

- **Limited Depth Sensing in Low-Light Environments:** The depth sensing capabilities of the Oak-D camera are limited in poorly lit environments, unless the AI infrared (IR) illumination feature is used.
- **Integration Challenges:** While the Oak-D camera offers extensive capabilities, integrating it into existing systems might require technical expertise.

5. Setting Up the Necessary Libraries

Before diving into the world of the Oak-D camera, it is important to set up the necessary libraries and dependencies. This section will guide you through the process step by step.

5.1 Installing Python and Required Libraries

Python is the language used for this project and requires the latest version of Python 3 to be installed. The depth AI examples use the OpenCV library for computer vision tasks. To install OpenCV, simply run the command `python3 -m pip install opencv-python`.

5.2 Using PyCharm as the Integrated Development Environment

PyCharm is an integrated development environment that simplifies the process of writing and running Python code. It is recommended to use PyCharm for this project. Download and install PyCharm from the [JetBrains Website](#).

5.3 Working with Virtual Environments

To ensure project isolation and avoid conflicts between different versions of libraries, it is best to work with virtual environments. PyCharm automatically creates a virtual environment for each project, allowing you to install project-specific libraries without affecting other projects. This practice ensures a smooth development experience.

6. Exploring the Depth AI Examples

The depth AI examples provided with the Oak-D camera are a great starting point for understanding its capabilities. This section will provide an overview of two examples: the Color Camera RGB Video and the Stereo Depth Video.

6.1 Understanding the Color Camera and RGB Video Example

The Color Camera and RGB Video example demonstrates how to capture RGB video using the Oak-D camera. It opens an OpenCV window showing the live video feed from the camera. This example allows users to gain [Insight](#) into the camera's color capabilities and serves as a baseline for further exploration.

6.2 Exploring the Stereo Depth Example

The Stereo Depth example showcases the Oak-D camera's depth sensing capabilities. It creates a 3D depth map by using the stereo and mono cameras. The example visualizes the depth map by rendering multiple views, providing a comprehensive understanding of the camera's depth [Perception](#).

7. Conclusion

The Oak-D AI powered camera is a remarkable tool for computer vision applications. Its versatility, affordability, and support for various AI models make it a valuable asset in fields such as robotics, engineering, and art. By understanding the setup process and exploring the provided depth AI examples, you can unleash the full potential of this powerful camera and dive into the world of AI powered computer vision.

Highlights

- The Oak-D AI powered camera combines hardware and software to enable advanced computer vision applications.
- Depth AI, the spatial AI platform embedded in the Oak-D camera, allows for the execution of various AI models.
- The Oak-D camera supports applications such as media pipe hand tracking, YOLO object recognition, gaze estimation, segmentation, and text detection.
- When compared to the Azure Camera, the Oak-D camera offers affordability, versatility, and the ability to load multiple AI models.
- Setting up the necessary libraries, using PyCharm as the IDE, and working with virtual environments are essential steps in utilizing the Oak-D camera.
- Exploring the provided depth AI examples, such as the Color Camera RGB Video and Stereo Depth Video, allows users to grasp the capabilities of the Oak-D camera.

FAQ

Q: Can the Oak-D AI powered camera be integrated into existing systems easily?

A: While the Oak-D camera offers extensive capabilities, integrating it into existing systems might require technical expertise due to its advanced features and dependencies.

Q: How does the depth sensing of the Oak-D camera work in poorly lit environments?

A: The stereo and mono cameras of the Oak-D camera rely on well-lit environments for accurate depth sensing. However, the Oak-D Pro version, equipped with AI infrared (IR) illumination, can provide depth sensing in poorly lit environments.

Q: Are there alternative cameras to the Oak-D for AI powered computer vision applications?

A: Yes, the Azure Camera is a popular alternative. However, the Oak-D camera offers advantages such as affordability, versatility, and the ability to load multiple AI models.

Q: What software is required to run the Oak-D camera?

A: The Oak-D camera requires the installation of Python, OpenCV, and the depth AI library. The PyCharm IDE is recommended for managing the project and running the examples.

Zed 2i

ZED 2i is an IP66-rated Rolling Shutter camera built for spatial analytics and immersive experiences, powered by Neural Depth Engine 2. Ready to deploy, it has a robust aluminum enclosure, high-performance IMU and USB 3.1 connection.

[ALL the info on ZED camera's](#)

Works on PC only

How to install: <https://www.stereolabs.com/docs/installation/windows>

Main Features

1. **Dual-Lens Stereo Vision:** Provides advanced depth perception and 3D mapping capabilities.
2. **Spatial Understanding:** Offers a detailed understanding of the surrounding environment.
3. **Motion Tracking:** Tracks objects and people in real-time with high accuracy.
4. **High-Resolution Imaging:** Captures high-quality images, essential for detailed visual work.
5. **Robust Build:** Designed for a variety of environments, enhancing versatility.
6. **Integrated Sensors:** Includes IMU, barometer, and magnetometer for comprehensive data collection.
7. **Flexible Connectivity:** USB 3.1 connection for easy integration with various systems.

Here are the links to the TouchDesigner documentation regarding ZED TOP, CHOP and SOP:

TOP: https://docs.derivative.ca/ZED_TOP

CHOP: https://docs.derivative.ca/ZED_CHOP

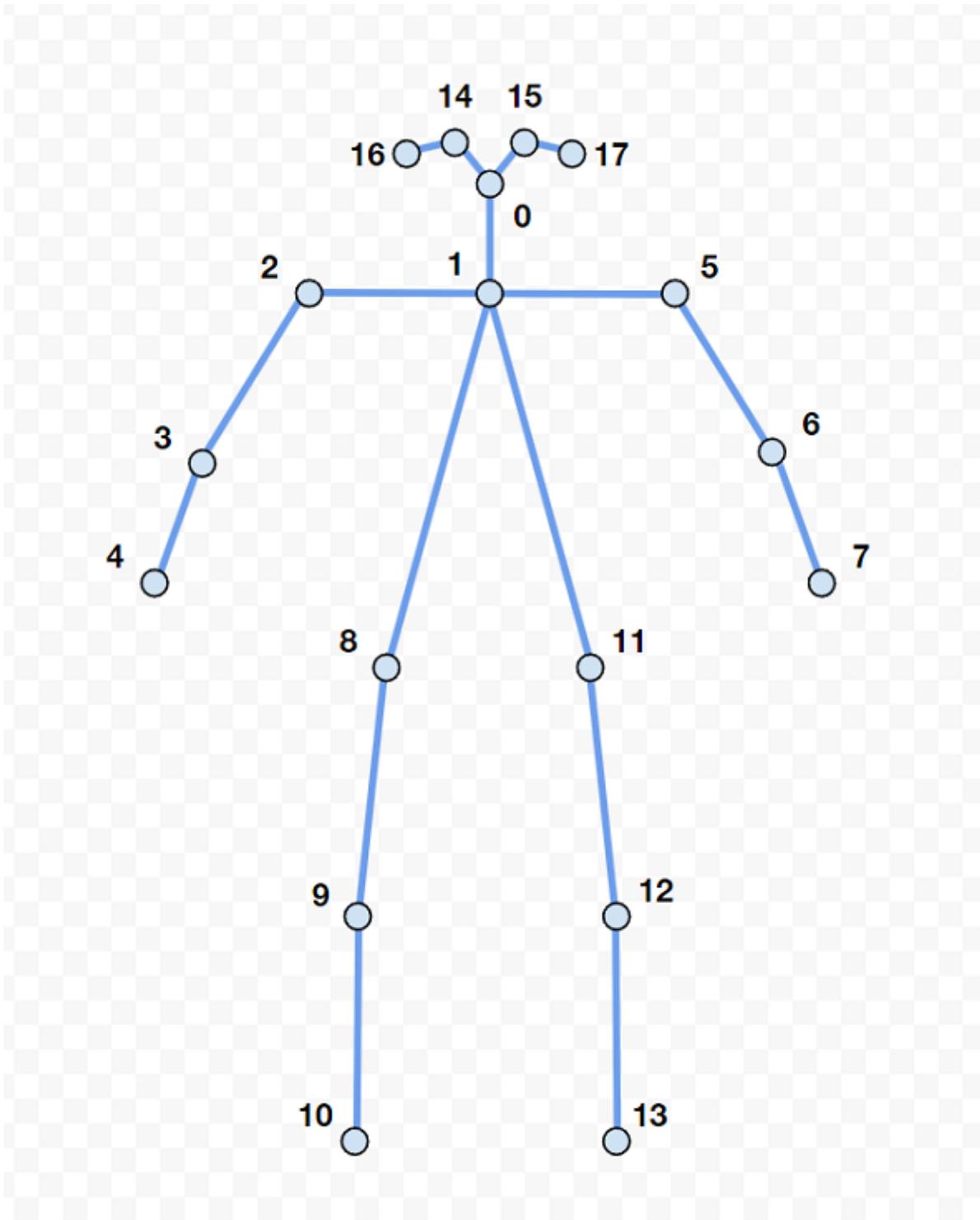
SOP: https://docs.derivative.ca/ZED_SOP

Also, if this is a topic of your interest, it might come in handy to have a look at the official ZED documentation:

<https://www.stereolabs.com/docs>

more info on <https://interactiveimmersive.io/blog/touchdesigner-integrations/updated-zed-camera-features-in-touchdesigner/>

Skeleton tracking keypoints (there are various options)



<https://www.youtube.com/embed/TGmSyy0VVq4>

<https://www.youtube.com/embed/bJVzg6q21lg>

<https://interactiveimmersive.io/blog/touchdesigner-integrations/updated-zed-camera-features-in-touchdesigner/>

Various Plugins & tutorials

Touchdesigner:

Orbec Astra : not natively supported because of being discontinued, this [Touchdesigner plugin](#) by Nuitech does the work for pc. Needs to be pulsed every 10 minutes (or buy Nuitech software).

OakD : OakD runs software called Depth Ai, info found [here](#), check it out to see more info on the specs

Support in TD is native.

<https://www.toolify.ai/ai-news/unleash-your-creativity-with-oakd-and-touchdesigner-208402>

Check out [these tutorials](#) to get started:

<https://www.youtube.com/embed/bXQM9byBA6o>

Hokuyu URG-04LX-UG01

Dit is even een lelijke ruwe dump van mijn eerste experimenten wordt nog opgeschoond

Machiel

Test getting data from Python(linux)

```
“ git clone https://github.com/pasuder/hokuyo-python-lib.git  
  
cd hokuyo-python-lib  
  
pip install -r requirements  
  
cd src/hokuyo/tests/  
  
PYTHONPATH="../.." python3 test_driver_laser.py
```

Output:

```
“ BM  
00P  
  
---  
{119.885: 762, 119.5329148311307: 754, 119.18082966226139: 742,  
118.82874449339208: 742, 118.47665932452277: 742, 118.12457415565346:  
785, 117.77248898678414: 785, 117.42040381791483: 790,  
117.06831864904552: 790, 116.71623348017621: 1166, 116.3641483113069:  
1166, 116.0120631424376: 1166, 115.65997797356829: 1019,  
115.30789280469898: 1019, 114.95580763582967: 1019,  
114.60372246696036: 1544, 114.25163729809105: 1548,  
113.89955212922173: 1550, 113.54746696035242: 1558,  
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110.02661527165932: 1596, 109.67453010279002: 1596, 109.3224449339207:
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105.80159324522761: 924, 105.4495080763583: 924, 105.09742290748899:
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113, 98.4078046989721: 108, 98.05571953010279: 107, 97.70363436123348:
105, 97.35154919236417: 101, 96.99946402349487: 98, 96.64737885462556:
91, 96.29529368575625: 84, 95.94320851688693: 81, 95.59112334801762: 80,
95.23903817914831: 79, 94.886953010279: 76, 94.53486784140969: 76,
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93.12652716593246: 71, 92.77444199706315: 68, 92.42235682819384: 68,
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87.8452496328928: 65, 87.4931644640235: 65, 87.14107929515419: 70,
86.78899412628488: 70, 86.43690895741557: 67, 86.08482378854626: 70,
85.73273861967695: 67, 85.38065345080764: 67, 85.02856828193833: 66,
84.67648311306903: 64, 84.32439794419972: 51, 83.97231277533041: 49,
83.6202276064611: 49, 83.26814243759178: 49, 82.91605726872247: 50,
82.56397209985316: 52, 82.21188693098385: 52, 81.85980176211454: 50,
81.50771659324523: 49, 81.15563142437591: 49, 80.8035462555066: 48,
80.4514610866373: 48, 80.09937591776799: 49, 79.74729074889868: 49,
79.39520558002937: 49, 79.04312041116006: 49, 78.69103524229075: 50,
78.33895007342144: 50, 77.98686490455214: 50, 77.63477973568283: 50,
77.28269456681352: 50, 76.93060939794421: 52, 76.5785242290749: 52,
76.22643906020559: 55, 75.87435389133628: 56, 75.52226872246696: 60,
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VV

00P

VEND:Hokuyo Automatic Co.,Ltd.:[

PROD:SOKUIKI Sensor URG-04LX-UG01(Simple-URG);[

FIRM:3.4.03(17/Dec./2012);T

PROT:SCIP 2.0;N

SERI:H1320257;I

PP

00P

MODL:URG-04LX-UG01(Simple-URG)(Hokuyo Automatic Co.,Ltd.);N

DMIN:20;4

DMAX:5600;_

ARES:1024;\

AMIN:44;7

AMAX:725;o

AFRT:384;6

SCAN:600;e

II

00P

MODL:URG-04LX-UG01(Simple-URG)(Hokuyo Automatic Co.,Ltd.);N

LASR:ON;9

SCSP:Initial(600[rpm])<-Default setting by user;A

MESM:Measuring by Normal Mode;0

SBPS:19200[bps]<-Default setting by user;A

TIME:06E03C;j

STAT:Sensor works well.;8

HS1

00P

HS0

00P

CR10

00P

CR99

00P

RS

00P

QT

00P

Touchdesigner

- https://docs.derivative.ca/index.php?title=Hokuyo_CHOP
- <https://miwa-maroon.medium.com/super-introduction-hands-on-interactive-content-with-hokuyo-sensors-and-touchdesigner-46e24f051a2>
- <https://interactiveimmersive.io/blog/touchdesigner-resources/blob-tracking-tricks-in-touchdesigner/>
- https://derivative.ca/UserGuide/Hokuyo_CHOP
- <https://www.youtube.com/watch?v=opDVtyOQIeY>
- <https://github.com/STARRYWORKS-inc/HokuyoUtil>
- https://www.youtube.com/watch?v=Xxw_gUPUcy8
- <https://alltd.org/hokuyo-sensor-touchdesigner-tutorial/>
- <https://github.com/huskyroboticsteam/urg-lidar> (driver)