# Autonomous Duckiebot:
# Ball detection and Tracking

BY:GROUP 6

Nitin Kumar Bhagat
Maurice Yan KAYIJAMAHE
Mohamed Amine Kina

# About the Project

The objective of this project was to implement a method that allows Duckiebots to reliably detect round/circular objects they may encounter when driving through a regular Duckietown and follow them.

# Problem Formulation

We seek to find a method that allows a Duckiebot to identify a specific object which is supposed to be circle in shape, in this instance a ball. In particular, we attempt to solve the following problem: Given a duckiebot camera has a few objects in front of it can identify a ball and can be able to follow it:

1) Initial localization of the rest position,
2) Determine the position of the grid of the object by taking a frame of an image and a center of a circle,
3) Continuous following with publisher to wheel commands and pose updates from Subscriber class that takes images and detect circles, the same method of the initial localization is used frame by frame.

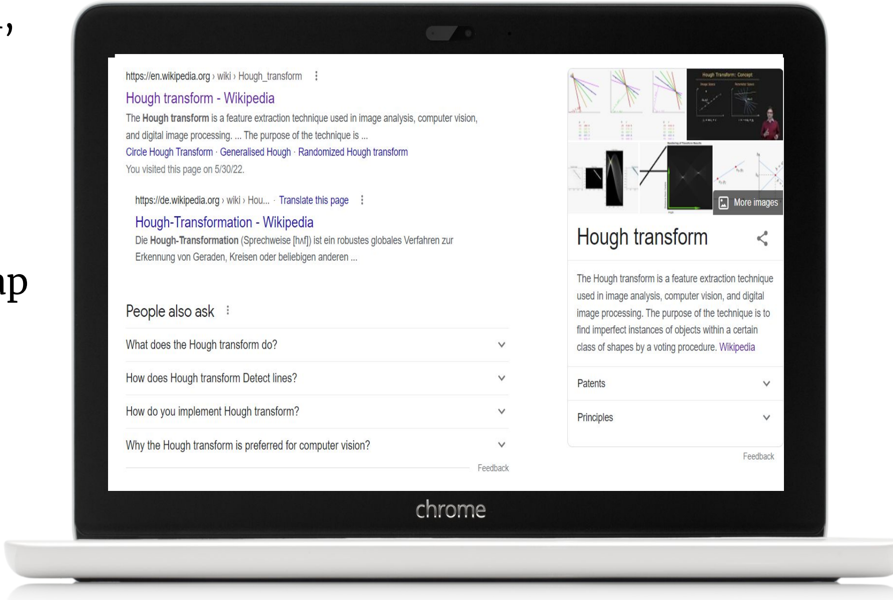
# Approach and Solution

## Hough Transforms

# How Does it work?

The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure.

The Hough transform takes a binary edge map as input and attempts to locate edges placed as straight lines. The idea of the Hough transform is, that every edge point in the edge map is transformed to all possible lines that could pass through that point



https://en.wikipedia.org › wiki › Hough_transform

Hough transform - Wikipedia

The **Hough transform** is a feature extraction technique used in image analysis, computer vision, and digital image processing. ... The purpose of the technique is ...

Circle Hough Transform · Generalised Hough · Randomized Hough transform

You visited this page on 5/30/22.

https://de.wikipedia.org › wiki › Hou... · Translate this page

Hough-Transformation - Wikipedia

Die **Hough-Transformation** (Sprechweise [hʌf]) ist ein robustes globales Verfahren zur Erkennung von Geraden, Kreisen oder beliebigen anderen ...

People also ask

What does the Hough transform do?

How does Hough transform Detect lines?

How do you implement Hough transform?

Why the Hough transform is preferred for computer vision?

Hough transform

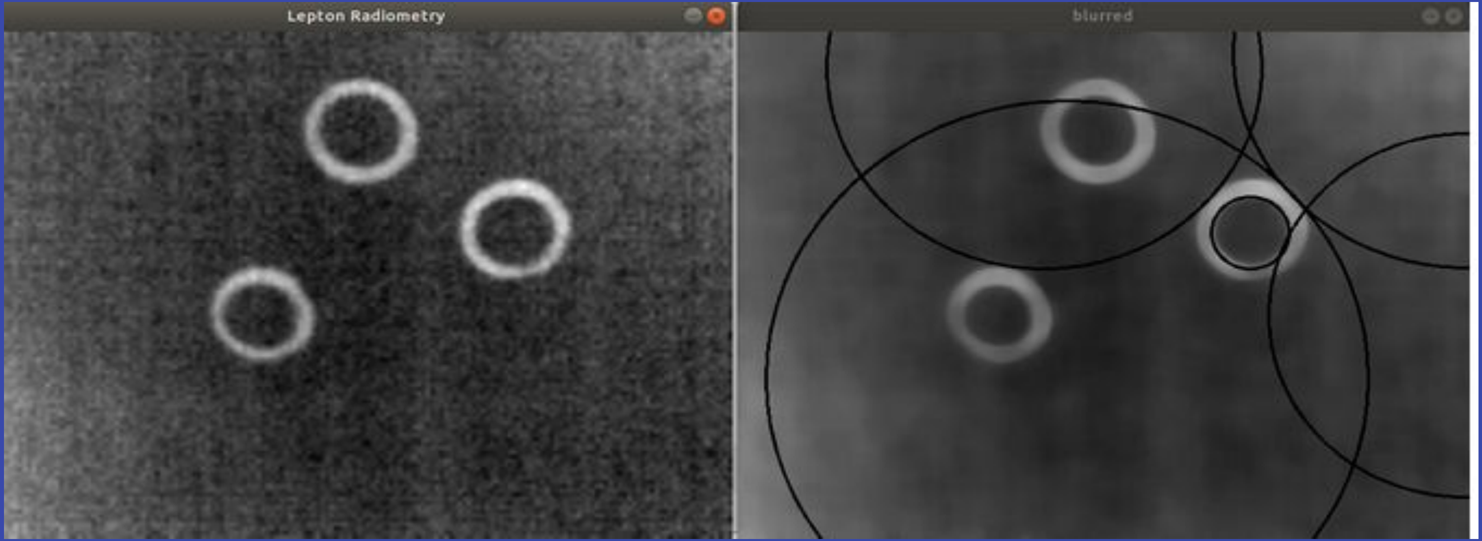
The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure. Wikipedia

# Implementation

**The approach in implementing the idea of circle hough transform(CHT):**

1. **‘utils.py’ contains the algorithm to detect the circle(ball in our case)**
2. **‘main.py’ contains publisher and subscriber nodes along with implementing  algorithm from util.py script.**

# CHT test result using



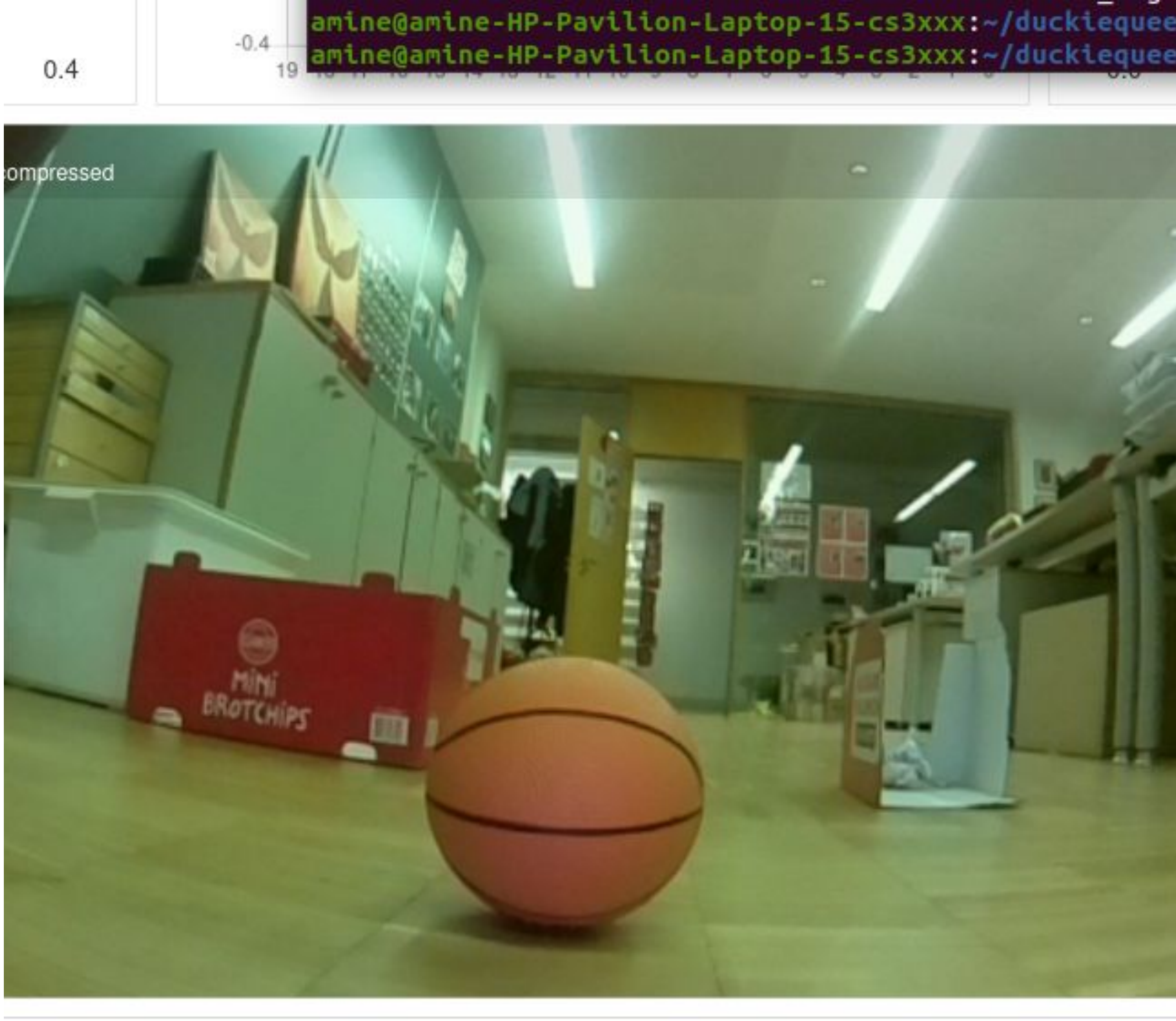
# Necessary arguments in algorithm function:

cv2.medianBlur: apply median blur filter to smooth the noise(salt and pepper noise)

cvtColor: converting the image to grayscale image for detection

HoughCIrcles: it has parameters like cv2.HOUGH_GRADIENT(defines detection method using cv2 library/mathematical formula to find circle),param1, param2( since HoughCircles() uses Canny() function, these para determines how aggressively ou want to detect edges), minDist, maxDist (min and max dist between centre of circles to be detected - determines closeness of circle in the image)

Image view of detection on the dashboard:



```
amine@amine-HP-Pavilion-Laptop-15-cs3xxx:~/duckiequee
amine@amine-HP-Pavilion-Laptop-15-cs3xxx:~/duckiequee
```

# Potential real life implementation:

1. Football footages in a match using a trained rover on pitchside that tracks the ball in a field with predetermined camera settings to record the football game.
2. Taking images and footage in tourism industry e.g. hot air ballon images and people in it at higher altitude.
3. Entertainment industry e.g. baseball games where the match moves around a ball or round object.
4. Detecting no. of people or head in the crowd.

Project-Output:

https://drive.google.com/file/d/1tby0Ar0WmqUBoEClwud2TsRSJ6CEXYj5/view?ts=629429ac

# Thanks!