AERIAL ROBOTICS
IIT KHARAGPUR

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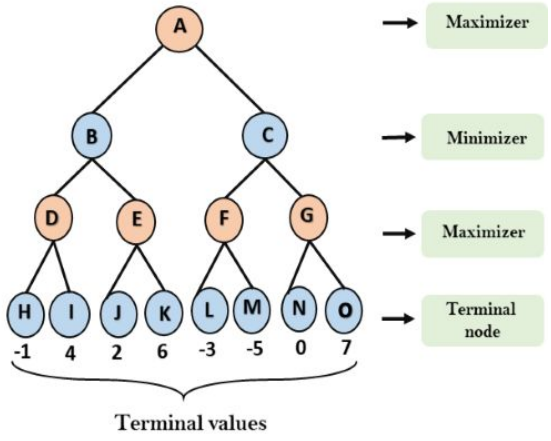
This documentation provides information about task 2.1 ; 2.2 ; 2.3 ; 3.2 .Some Information about the algorithms and the programs written and finally some further progress which has to be made.

TASK 2.1 :- TIC TAC TOE USING MINIMAX

About Minimax Algorithm--

Minimax is a decision rule used in artificial intelligence, decision theory, game theory, statistics, and philosophy for *mini*mizing the possible loss for a worst case (*max*imum loss) scenario.



AIM:- And then each step you take you, want to maximize your win and your friend also wants to minimize his loss. Eventually, it's the same definition for both of you. Your next decision should be maximizing your current win position knowing that your friend in the next step will minimize his loss position and knowing that the next step you will also maximize your win position...

In this task we had to make a tic tac toe game in which the opponent(or computer) uses the minimax algorithm to find its best possible move at every given situation of the game.(since i couldn't set up the proper environment so i made the game using a simple 2d array)

-->IN THE FIRST PROGRAM , IT IS A SIMPLE TIC TAC TOE GAME TO BE PLAYED BETWEEN TWO PLAYERS(without minimax).

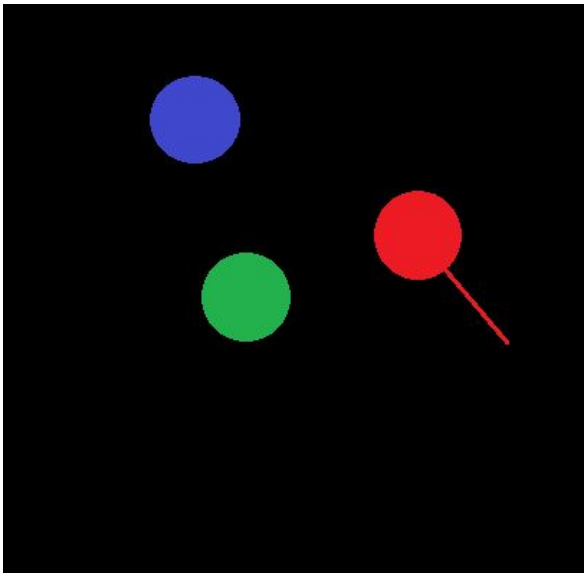
-->IN THE FINAL PROGRAM I MADE THE GAME TO BE PLAYED AGAINST THE COMPUTER WHICH USES MINIMAX ALGORITHM.

Conclusion:--

Where should you use this information? Anywhere you have to make or do decision-based on user action. Most often it might be games, but then, you can use your

fantasy to integrate it in a place where you would have to reflect on any performed action. The only thing you need to understand is the algorithm for two parts that are "playing" against each other

TASK 2.2 :- ELASTIC COLLISION BETWEEN BALLS



The task given to us was to show the effect of collision between the balls until a given number of collisions.
I have used balls of different colors instead of all white which could also be converted into ball of borders of different colors to show the motion and check the collision and to keep track of which ball is in motion.
We have to take into account the collision between the balls and the walls as well.

I have taken into account the variable angle which varies from 0 to 360 to get the direction of motion of the ball.Wrote different functions for each type of collision between balls and the wall and the angle change with respect to that.
Making this program was the best part of the task as i help me to work with various functions at the same time in a program and think of the various kinematic parts behind it.

FURTHER PROGRESS:--

I got to figure out some error in my code which once the balls collide it remains in contact and colliding continuously which shouldn't happen.
Then try for more than 3 balls in which we can either represent them with different colors or a black and white image with white balls and coloured background.

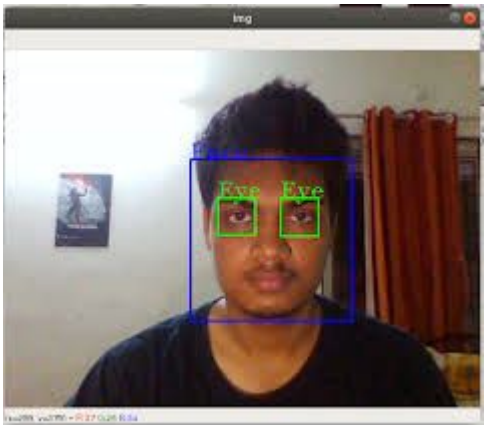
TASK 2.3 :-- FLAPPY BIRD GAME

FACE DETECTION :--

-->What is "Face Detection"?

Face detection is a type of application classified under "computer vision" technology. It is the process in which algorithms are developed and trained to properly locate faces or objects (in object detection, a related system), in images. These can be in real time from a video camera or from photographs. An example where this technology is used are in airport security systems.

-->What are its real life applications ?

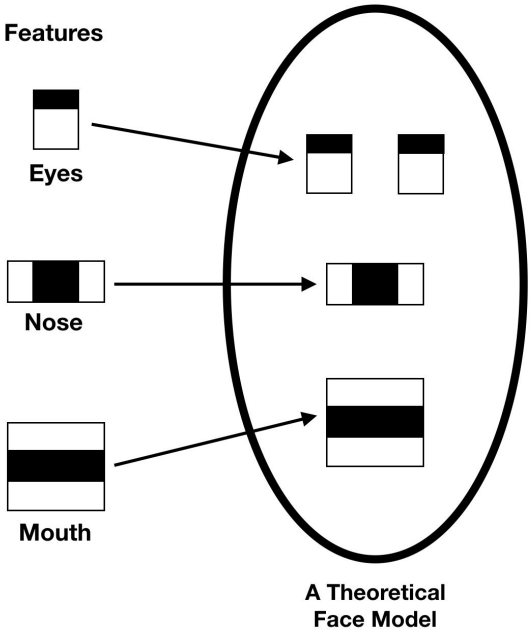


Face detection is one of the fundamental applications used in face recognition technology. Facebook, Amazon, Google and other tech companies have different implementations of it. Before they can recognize a face, their software must be able to detect it first. Amazon has developed a system of real time face detection and recognition using cameras. Facebook uses it mostly on photos that their users upload in order to suggest tagging friends.

Understanding Haar Cascades

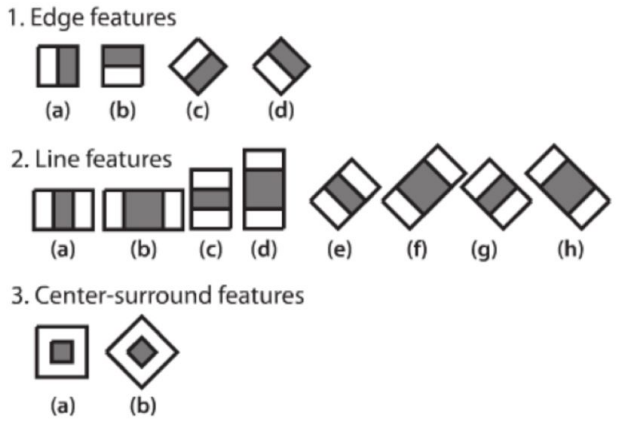
A *Haar Cascade* is based on "Haar Wavelets" which Wikipedia defines as:

A sequence of rescaled "square-shaped" functions which together form a wavelet family or basis.



It is based on the Haar Wavelet technique to analyze pixels in the image into squares by function. This uses machine learning techniques to get a high degree of accuracy from what is called "training data". This uses "integral image" concepts to compute the "features" detected. Haar Cascades use the **Adaboost** learning algorithm which selects a small number of

important features from a large set to give an efficient result of classifiers.



Face Detection determines the locations and sizes of human faces in arbitrary (digital) images.

In **Face Recognition**, the use of Face Detection comes first to determine and isolate a face before it can be recognized.

-->IN THE FIRST PROGRAM IS ONLY FOR FACE AND EYE DETECTION IN WHICH A RECTANGLE IS MADE AROUND THE FACE AND A CIRCLE IS MADE AROUND THE EYE.
-->IN THE SECOND PROGRAM THIS FACE DETECTION IS USED TO MAKE THE FLAPPY BIRD GAME WITH PASSING THE COORDINATE OF EYE TO MAKE CIRCLE AND CHECK FOR COLLISION OF CIRCLE WITH BLOCK AND TO MAKE BLOCKS OF DIFFERENT LENGTH AND MOVE THEM ACROSS THE SCREEN.

FURTHER PROGRESS:--
There has been a problem with the detection of face in the second program whose error i couldn't understand.I need to rectify that.
A further progress which could be made is to add levels and vary the difficulty in the obstacles by varying their sizes and making more than one appear on the screen

TASK 3.2 :-- RADAR DETECTION

In this program we were given a csv file containing all the data of the aircrafts with time and we had to detect the true coordinates which detect the aircraft.
TO MAKE THIS PROGRAM I THOUGHT OF EXTRACTING THE DATA (COORDINATES) FROM THE CSV FILE AND DISPLAY THEM IN 3 DIFFERENT COORDINATE AXIS BY PLOTTING THREE GRAPHS.THE DATA WHICH GIVES A PECULIAR TRAJECTORY IS OF THE AIRCRAFT WHERE AS THE OTHER RANDOM SPOTS ARE OF OTHER UNKNOWN OBJECTS OR BIRDS.HENCE THE MISSING RADAR COORDINATES COULD BE FOUND OUT BY FOLLOWING THE TRAJECTORY.

FURTHER PROGRESS:--
A further progress that could be made is to plot a 3d graph instead of three 2d graphs to give a better representation of the trajectory and to find the precise coordinates of the missing points finding the regular distances between the points in 3d and then approximating the missing coordinates.(this is considering the aircraft moves with same speed throughout)