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Department of Computer Science and Engineering
[Data Science]

HAND GESTURE RECOGNITION AND VIRTUAL MOUSE

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PROJECT GUIDE : MAYA VARGHESE

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Contents

- Introduction
- Problem Statement
- Literature Survey
- Proposed System
- Process Design
- Details of Hardware/Software used
- Experiment and Result
- Conclusion and Future work
- References

Thank you

Introduction

- Development of user interfaces influences the changes in the Human-Computer Interaction (HCI)
- Non verbal interaction
- Image processing techniques
- substantially applied towards different applications like controllers, image browser, games, sign language and many more which in general uses gesture recognition.

Problem Statement

HAND GESTURE RECOGNITION AND VIRTUAL MOUSE

- Traditional mouse and touchpad
- Physical device_
wear and tear i.e maintenance
- Other system drawbacks_
Static / coloured gloves
- To design system_
Realtime (Dynamic)
Not require any external material
Decent accuracy

Literature Survey

Sr. No	Paper Title	Advantages	Disadvantages
1	Gesture Recognition of RGB and RGB-D Static Images Using Convolutional Neural Networks	2 stage freezing layers for tackling overfitting	It is static
2	Hand Gesture Recognition system for numbers using thresholding	Thresholding concept is applied	Colored glove is requisite
3	Convolutional network and its application in deep learning	Convolutional Neural network tries to learn good features in relatively small dataset	---

Process Design

Module
1

Data collection
and filtering

System
configuration

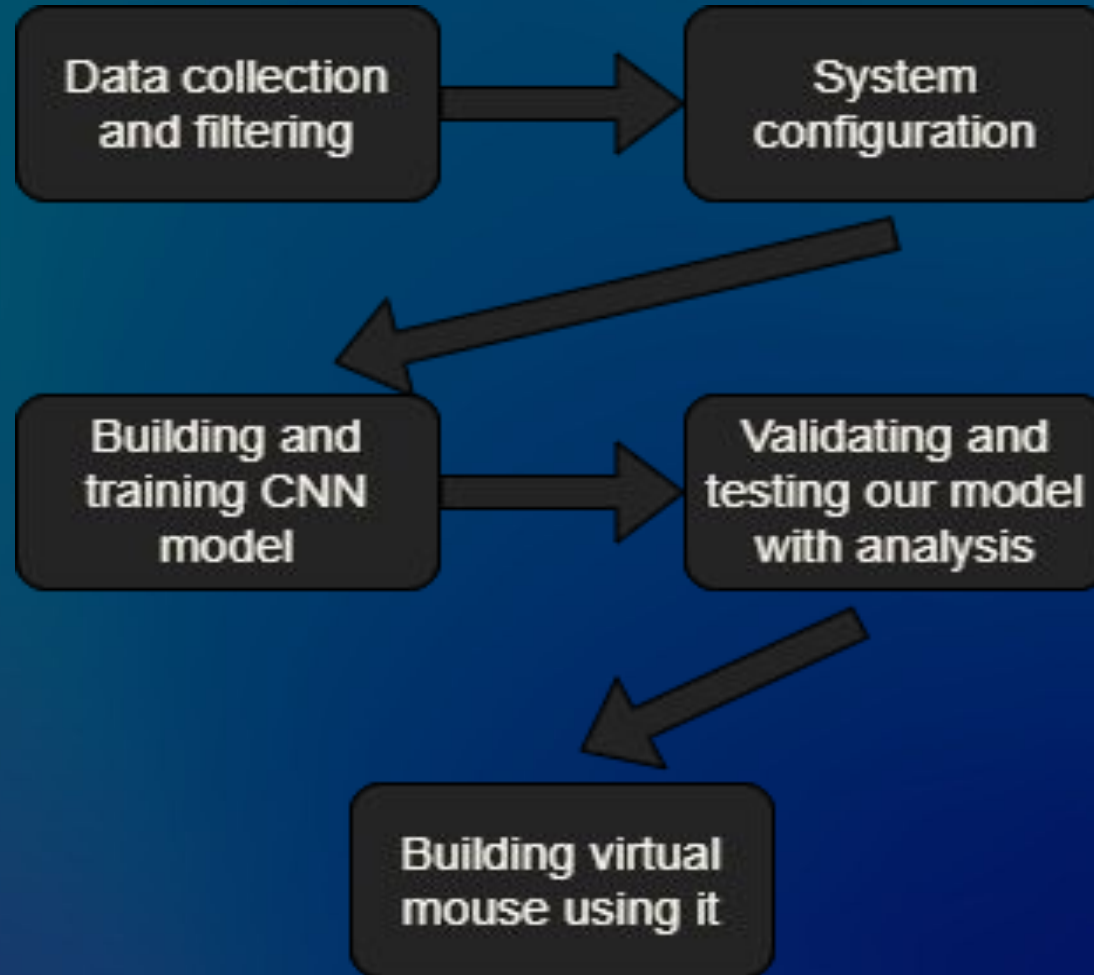
Module
2

Building and
training CNN
model

Validating and
testing our model
with analysis

Module
3

Building virtual
mouse using it



Proposed System

- Configured system to meet requirements of our project by installing dependencies and external hardware.
- Downloaded the dataset from the web and filtered it as per requirements.
- Trained a model using CNN to recognize different hand gestures and output to frame.
- Each gesture is trained by images of 64 by 64 pixels each. Model is then validated and tested.
- Model has achieved above 98% accuracy on testing data. Using this model, making a mouse controller which uses specific gestures for specific tasks respectively.

Details of Hardware/Software used

SOFTWARE-

VS code

Python 3.5 and above

Dependencies_

Opencv == 4.5.4.58

Numpy == 1.21.4

Tensorflow == 2.7.0

Keras == 2.7.0

PyAutoGUI == 0.9.53

HARDWARE-

Intel core i5-2430M, 3.00GhZ

Ram : 8 gigabytes

Webcam : 12 megapixel (Droidcam)

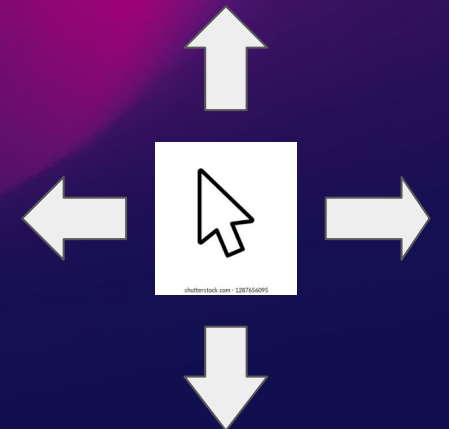
Graphic card : Intel integrated graphics

64 bit architecture operating system



Experiment and Result

Result_



Gestures and corresponding mouse movements



Upward pointer movement



Downward pointer movement



Rightward pointer movement



Leftward pointer movement



Left click



Right click

ACCURACY

This is picture taken visualizing accuracy when model is being trained

```
1800/1800 - 413s - loss: 0.4997 - accuracy: 0.8401 - val_loss: 0.2242 - val_accuracy: 0.9240 - 413s/epoch - 230ms/step
Epoch 2/100
1800/1800 - 380s - loss: 0.0871 - accuracy: 0.9733 - val_loss: 0.1588 - val_accuracy: 0.9487 - 380s/epoch - 211ms/step
Epoch 3/100
1800/1800 - 381s - loss: 0.0641 - accuracy: 0.9808 - val_loss: 0.0581 - val_accuracy: 0.9822 - 381s/epoch - 211ms/step
Epoch 4/100
1800/1800 - 378s - loss: 0.0620 - accuracy: 0.9822 - val_loss: 0.1054 - val_accuracy: 0.9710 - 378s/epoch - 210ms/step
Epoch 5/100
1800/1800 - 414s - loss: 0.0389 - accuracy: 0.9889 - val_loss: 0.0913 - val_accuracy: 0.9703 - 414s/epoch - 230ms/step
Epoch 6/100
1800/1800 - 406s - loss: 0.0402 - accuracy: 0.9873 - val_loss: 0.0372 - val_accuracy: 0.9868 - 406s/epoch - 225ms/step
Epoch 7/100
1800/1800 - 516s - loss: 0.0361 - accuracy: 0.9887 - val_loss: 0.1487 - val_accuracy: 0.9568 - 516s/epoch - 287ms/step
Epoch 8/100
1800/1800 - 544s - loss: 0.0335 - accuracy: 0.9907 - val_loss: 0.0969 - val_accuracy: 0.9785 - 544s/epoch - 302ms/step
Epoch 9/100
1800/1800 - 634s - loss: 0.0314 - accuracy: 0.9907 - val_loss: 0.0618 - val_accuracy: 0.9830 - 634s/epoch - 352ms/step
Epoch 10/100
```

ACCURACY

- Validation accuracy of our model is above 98%.
- Model is first trained on trained dataset and then validated on validation directory of dataset.
- Validation accuracy is calculated by model automatically using validation dataset.
- Accuracy is calculated using built-in parameter of fit method.

Conclusion

- Making an accurate model which along with analyzed information, detects hand gestures with accuracy above 98% after validation, testing model on both images from the dataset and real-time webcam's captured feed.
- This architecture is expanded to "Virtual Mouse" which in real-time operates and performs specific tasks based on detected gestures. 6 gesture out of 20 correspond to predefined functionality and the user is able to control their system's mouse

FUTURE WORK

This pretrained model has infinite potential and can be used in vast variety of fields where one wants to control something using his/her gestures

Examples: hardware controls like drone manoeuver, robotics control
virtual softwares like virtual keyboard, music controller, e.t.c

References

“Neural network and deep learning” book by michel nielsen
Manju Khari, Aditya Kumar Garg, Rubén González Crespo , Elena Verdú *Gesture Recognition of RGB and RGB-D Static Images Using Convolutional Neural Networks*

doi: 10.9781/ijimai.2019.09.002

Bhavsar Swapna, Futane Pravin, V.Dharaskar Rajiv, *Hand Gesture Recognition System for Numbers Using Thresholding* , (), 1-5.

doi:

LeCun, Yann; Kavukcuoglu, Koray; Farabet, Clement (2010). *Convolutional networks and applications in vision.* , (), 253–256.

doi: 10.1109/iscas.2010.5537907

THANK YOU