Adaptive Face Filters

AI Model Development

Time: 60 mins

Introduction

In this class, the student/s will learn to detect face and apply image filters on a face using hand gestures.

New Commands Introduced

- math.dist() — Helps to provide the distance between the two given parameters
- FaceMeshDetector() — Detects the face in the camera feed
- findFaceMesh() — Finds and stores the face mesh with landmarks
- cvzone.overlayPNG() — Helps overlay the pictures and textures on the picture

Vocabulary

- The **face mesh detector** generates a face mesh for detected faces, each containing 468 3D points and edges which can be used to perform more accurate operations on faces in real-time.
- **Resize factor** is a number by which the size of any geometrical figure or shape can be changed with respect to its original size.

Learning Objectives

Student/s should be able to:

- ***Recall*** use of hand detector library and introduce face mesh detection library.
- ***Demonstrate*** how to detect face mesh with landmarks and place image filters over it.
- ***Explain*** the scaling and positioning of different image filters to accurately fit the filters.

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Activities

1. **Class Narrative:** *(2 mins)*
    - Brief the student/s that the image filters are ready and can be placed on the face using hand gestures.

2. **Concept Introduction Activity:** *(5 mins)*
    - Let the student/s play the explore-activity to drag the image filter over the face

- Using the slides, explain that the student/s will learn:
    - to place the filter on the face.
    - to resize the image filter
    - to scale and reposition the filter image.

3. **Activity 1: Place the Filter on Face** *(14 mins)*

    Teacher Activity: *(7 mins)*
- Introduce the FaceMeshDetector library and explain face landmarks to apply intelligence to the face filter app.

- Explain how to overlay the filter image on the landmark point.

    Student Activity: *(7 mins)*

- Guide the student/s to place the filter image on the face using Face Mesh Detector.

4. **Activity 2: Resize the Filter Image** *(12 mins)*

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    Teacher Activity: *(6 mins)*
- Ask the students to notice that the face dimensions change while moving back and forth.

- Explain how resizing the filter image as per width of the face can accurately place the filter image.

    Student Activity: *(6 mins)*

- Guide the student/s to resize the filter image using resize factor along with the changing width of the face.

5. **Activity 3: Scale and Position the filter images** *(12 mins)*

    Teacher Activity: *(6 mins)*
- Ask the students to observe the discrepancies in applying filters in the given gif and highlight the need of scaling and repositioning the filters.

- Demonstrate defining resizing factor, differential position values dx and dy for first 2 filters.

    Student Activity: *(6 mins)*

- Guide the student/s to scale and resize the remaining image face filters.

6. **Introduce the Post class project:** *(2 min)*
    - Create a filter which will adapt to the user's facial expression.

7. **Test and Summarize the class learnings:** *(5 mins)*
    - Check for understanding through quizzes and summarize learning after respective missions.
    - Summarize the overall class learning towards the end of the class.

8. **Additional activities:**
    - Encourage the student/s to add an AI mask filter to the filters menu.
    - Encourage the student/s to apply multiple filters at a time on the face.

9. **State the Next Class Objective:** *(1 min)*
    - In the next class, student/s will learn to create AI tools using Machine Learning and Neural Networks.

U.S. Standards:

CSTA: 2-AP-11, 2-AP-12, 2-AP-13, 2-AP-14, 2-AP-19

Links Table		
Activity	**Activity Name**	**Link**
Class Presentation	Adaptive Face Filters	https://s3-whjr-curriculum-uploads.whjr.online/b7129919-9335-4ceb-b90e-60054344b550.html
Explore Activity	Adaptive Face Filters	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS-BP
Teacher Activity 1	Place the Filter on Face	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-TAS-BP
Teacher Reference: Teacher Activity 1 Solution	Place the Filter on Face: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-TAS
Student Activity 1	Place the Filter on Face	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS-BP
Teacher Reference: Student Activity 1 Solution	Place the Filter on Face: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS
Teacher Activity 2	Resize the Filter Image	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-TAS-BP
Teacher Reference: Teacher Activity 2 Solution	Resize the Filter Image: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-TAS
Student Activity 2	Resize the Filter Image	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS-BP
Teacher Reference: Student Activity 2 Solution	Resize the Filter Image: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS
Teacher Activity 3	Scale and Position the Filter Image	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-TAS-BP
Teacher Reference: Teacher Activity 3 Solution	Scale and Position the Filter Image: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-TAS

Student Activity 3	Scale and Position the Filter Image	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS-BP
Teacher Reference: Student Activity 3 Solution	Scale and Position the Filter Image: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS
Student's Additional Activity 1	Add a Filter to the App	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS-BP
Teacher Reference: Student's Additional Activity 1 Solution	Add a Filter to the App: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS
Student's Additional Activity 2	Apply Multiple Filters	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS-BP
Teacher Reference: Student's Additional Activity 2 Solution	Apply Multiple Filters: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-SAS
Post Class Project	Adaptive Emojis	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-PCP-BP
Teacher Reference: Post Class Project Solution	Adaptive Emojis: Solution	https://github.com/Tynker-Computer-Vision/TNK-M9-PRO-C72-PCP