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Visualize Activation Maps Report

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1 Introduction

The activation map task focuses on visualizing the internal workings of a Convolutional Neural Network (CNN) trained for emotion detection. Activation maps offer insights into how the model extracts features and identifies patterns in input images.

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2 Background

Activation maps are visual representations of the features detected by each convolutional layer in a CNN. They help explain how the model interprets input images, offering transparency and interpretability in deep learning models.

In this task, a trained emotion detection model was used to visualize activation maps for grayscale facial images of size 48x48 pixels.

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3 Learning Objectives

- Understand the inner workings of a trained CNN.
- Learn to generate activation maps to explain model predictions.
- Enhance the interpretability of deep learning models for debugging and validation.

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4 Activities and Tasks

- **Model Loading**: Load the pre-trained model (model_a.json and model_weights.h5).
- **Image Preprocessing**: Prepare grayscale images by resizing and normalizing them.
- **Activation Maps Extraction**: Identify convolutional layers and extract activation outputs.
- **Visualization**: Display activation maps for each convolutional layer using matplotlib.

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5 Skills and Competencies

- Proficiency in Python and TensorFlow.
- Knowledge of convolutional neural networks and their layer structures.
- Understanding of image preprocessing techniques.
- Data visualization using matplotlib.

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6 Feedback and Evidence

- Successfully visualized activation maps for convolutional layers.
- Observed the feature extraction process across different layers of the model.
- Gained insights into how the model processes input images to detect emotions.

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7 Challenges and Solutions

- **Challenge**: Normalizing and clipping filter outputs for visualization.
  - **Solution**: Applied statistical normalization and ensured values were clipped within the 0–255 range.
- **Challenge**: Handling models with multiple convolutional layers.
  - **Solution**: Dynamically extracted outputs for all layers containing "conv" in their name.

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8 Outcomes and Impact

- Improved understanding of CNN feature extraction mechanisms.
- Enhanced transparency of the emotion detection model for debugging and validation.
- The approach can be reused to interpret other image classification models.

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9 Conclusion

The activation map task demonstrated the utility of visualization techniques in explaining the internal processes of CNNs. By generating activation maps, developers and researchers can ensure that models are learning meaningful features and can improve the interpretability of deep learning systems.