Truth or Lie:

Resnet for Video-based Lie Detection"

DS 542
Fall 2024
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Background Introduction

- ❏ Detecting deception is a challenge in areas like law enforcement and security, where accuracy is critical.

- ❏ While humans rely on cues like body language or facial expressions to spot lies, it's not always reliable.

- ❏ *This project, "Truth or Lie," aims to develop a deep learning model that analyzes videos to detect when someone is lying.*

Data preprocessing

- ❏ Approximately 850 videos.
- ❏ Truth and lie videos are balanced.
- ❏ Each video varies in length(20s~80s).
- ❏ Each video features a single main character.
- ❏ A person may appear in multiple videos but consistently tells either truth or lies across all their videos.
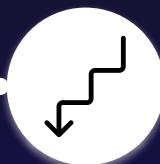
Import cv2
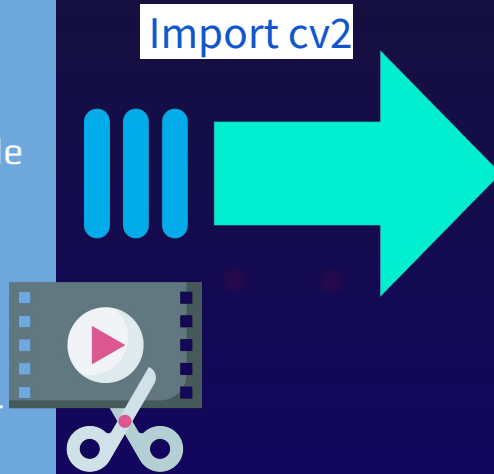
- ❏ Frame Extraction: Video frames are extracted at a specific frame rate, resized to a fixed size (224x224), and normalized.
- ❏ Sequence Data: Each video is represented as a sequence of frames. If a video has fewer frames than the desired sequence length, blank frames are used.
- ❏ Dataset Split: Try to ensure each person appears only in one dataset(train or validation).

Residual Neural Network

Gradient Descent:
Adam Optimizer

Base Model:
ResNet-18
(lr = 3e-5,
Binary
classification)

Loss Function:
Cross Entropy
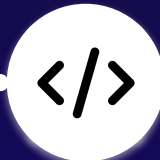
Regularization:
Dropout, Weight Decay,
Early Stopping

Evaluation:
Accuracy

Best Result and Evaluation

```
Epoch 1/20, Training Loss: 0.7402
Validation Loss: 0.6669, Accuracy: 54.25%
Epoch 2/20, Training Loss: 0.6855
Validation Loss: 0.6362, Accuracy: 61.13%
Epoch 3/20, Training Loss: 0.6503
Validation Loss: 0.6104, Accuracy: 65.18%
Epoch 4/20, Training Loss: 0.6260
Validation Loss: 0.5878, Accuracy: 68.42%
Epoch 5/20, Training Loss: 0.6153
Validation Loss: 0.5670, Accuracy: 69.23%
Epoch 6/20, Training Loss: 0.5999
Validation Loss: 0.5488, Accuracy: 72.87%
Epoch 7/20, Training Loss: 0.5819
Validation Loss: 0.5329, Accuracy: 75.71%
Epoch 8/20, Training Loss: 0.5603
Validation Loss: 0.5162, Accuracy: 77.33%
Epoch 9/20, Training Loss: 0.5410
Validation Loss: 0.5019, Accuracy: 79.35%
Epoch 10/20, Training Loss: 0.5266
Validation Loss: 0.4885, Accuracy: 80.57%
```

```
Epoch 11/20, Training Loss: 0.4934
Validation Loss: 0.4766, Accuracy: 80.97%
Epoch 12/20, Training Loss: 0.5213
Validation Loss: 0.4685, Accuracy: 80.16%
Epoch 13/20, Training Loss: 0.5054
Validation Loss: 0.4597, Accuracy: 82.19%
Epoch 14/20, Training Loss: 0.4779
Validation Loss: 0.4507, Accuracy: 82.19%
Epoch 15/20, Training Loss: 0.4947
Validation Loss: 0.4380, Accuracy: 82.19%
Epoch 16/20, Training Loss: 0.4781
Validation Loss: 0.4313, Accuracy: 83.00%
Epoch 17/20, Training Loss: 0.4513
Validation Loss: 0.4222, Accuracy: 84.21%
Epoch 18/20, Training Loss: 0.4498
Validation Loss: 0.4143, Accuracy: 84.62%
Epoch 19/20, Training Loss: 0.4591
Validation Loss: 0.4111, Accuracy: 85.02%
Epoch 20/20, Training Loss: 0.4411
Validation Loss: 0.4018, Accuracy: 86.64%
```

Best Result and Evaluation

DataSet	Accuracy
Training Set	87.28%
Validation Set	86.64%
Test Set	81.25%

```
evaluate_model(model, train_loader)
evaluate_model(model, validation_loader)
evaluate_model(model, test_loader)

Accuracy: 87.28%
Accuracy: 86.64%
Accuracy: 81.25%
```

Review and Discussion

The model's results show high accuracy, suggesting strong effectiveness.

However, its reliability may be limited due to the small sample size, which affects generalization. While the dataset includes 850 videos, these are short clips derived from fewer than 50 longer videos. This lack of diversity may reduce the representativeness of the data.

Additionally, if a person tells the truth in some clips and lies in others, it is uncertain whether the model can accurately identify the distinguishing features to make correct predictions.