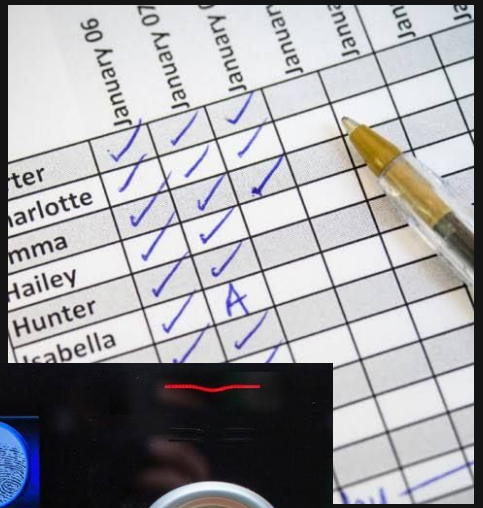
A COMPARATIVE STUDY ON FACIAL RECOGNITION BETWEEN CONVOLUTIONAL NEURAL NETWORK AND RECURRENT NEURAL NETWORK PERFORMANCE

JASPER R. SUNGA

Background of the Study

Hassle on Attendance Checking

Alternatives



Background of the Study

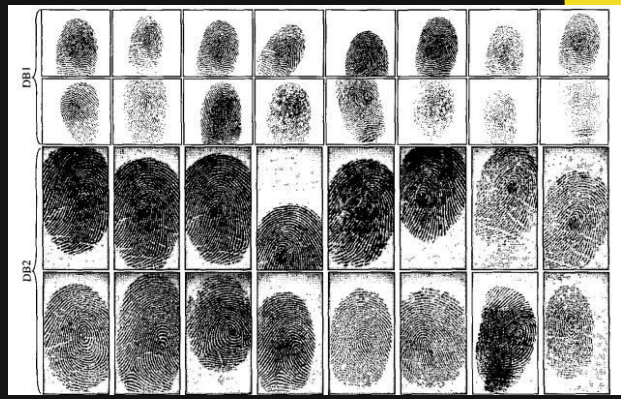
- Smartphone Camera Quality
- Face Detection Technological Advancements

Problem

Privacy

Database for Face Recognition

or Any Recognition Algorithms



Solution

Compare the better Neural Network to Use Given Constraints

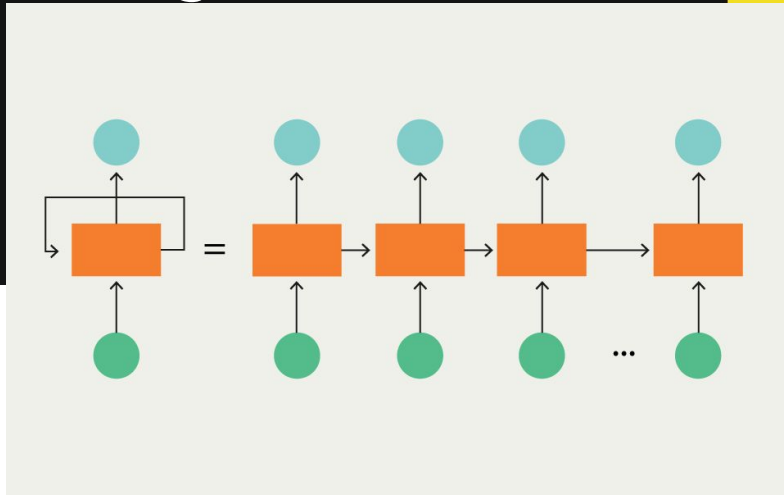
- No global database
- Training will be done concurrently with the lecture

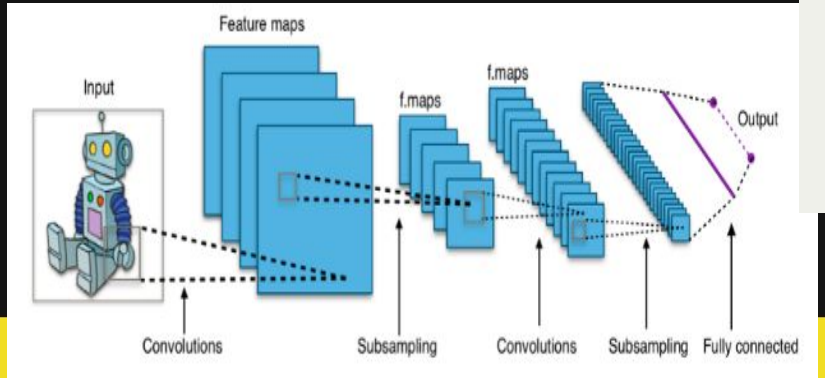
Objectives

Compare CNN and RNN performance given

No pre-existing data set

Limited data set



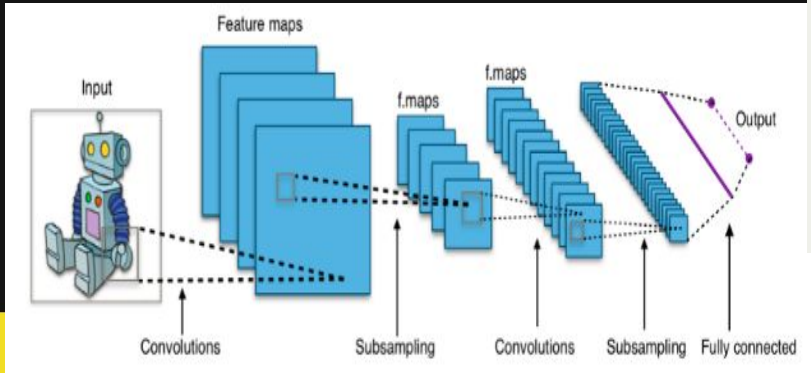


Objectives

CNN - Well-known for image classification

RNN - Event prediction, but sometimes

Used in face recognition



Objectives

- Create face data set per day for the models to train
- Split pictures from data set for testing accuracy per day
- Analyze CNN and RNN models’ performance

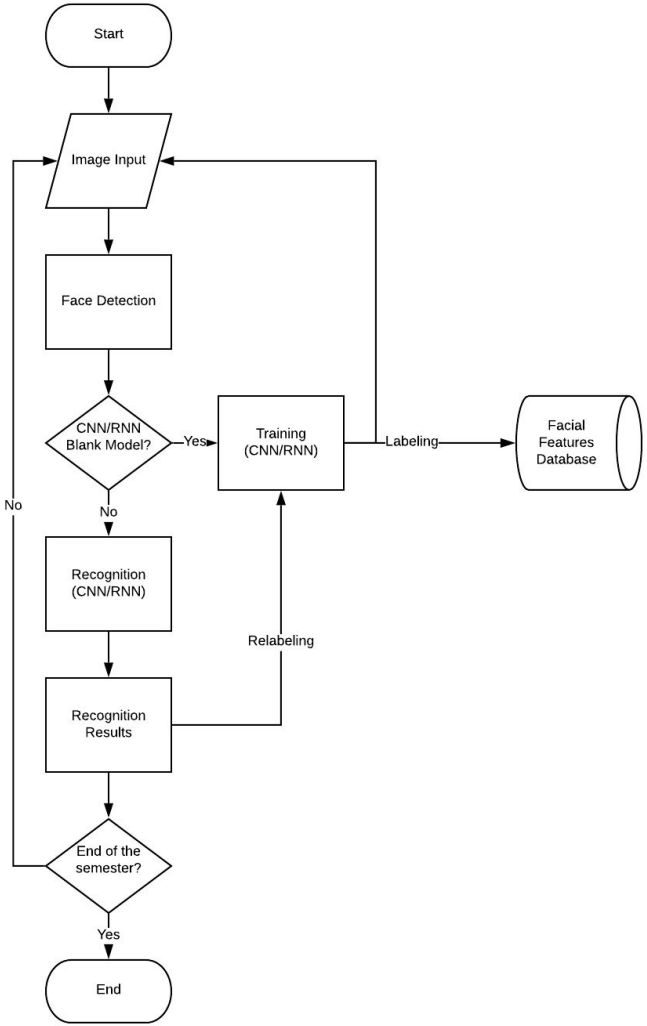
Methodology

Image Input

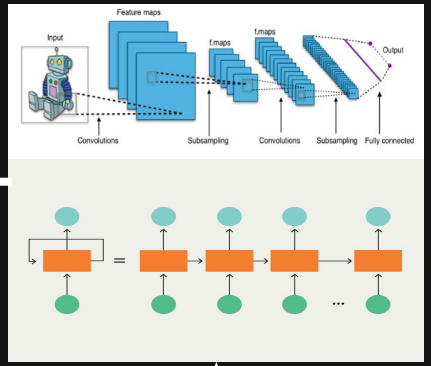
Face Detection

Training and Recognition

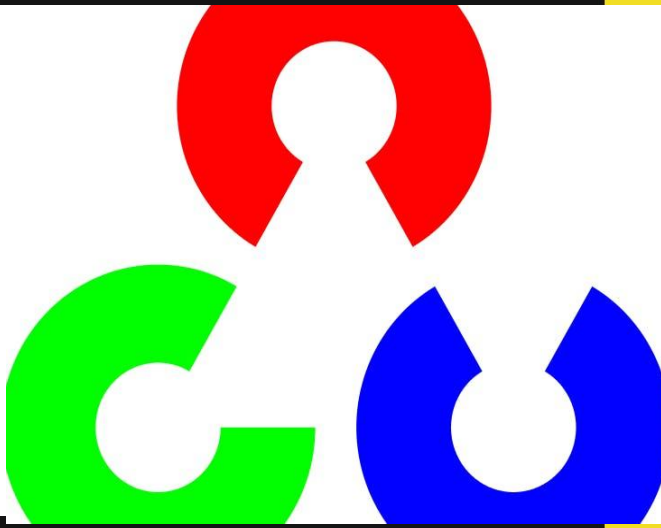
Recognition Results



Methodology



Methodology



Met


NO SMOKING
BATONG MALAKE
CARES
NO LITTERING
BATONG MALAKE
CARES

Methodology

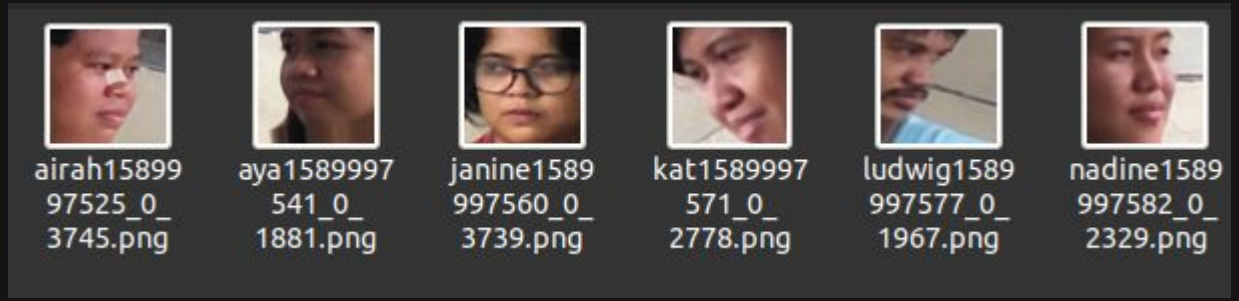
Poses:

1. Facing directly to the camera
2. Facing 30 degrees to the left
3. Facing 30 degrees to the right
4. Facing 30 degrees to the upward
5. Facing 30 degrees to the downward
6. Facing 30 degrees to the upper-right
7. Facing 30 degrees to the lower-right
8. Facing 30 degrees to the upper-left
9. Facing 30 degrees to the lower-left
10. Any angle determined by the subject

Methodology

Detected Faces

Augmented Faces

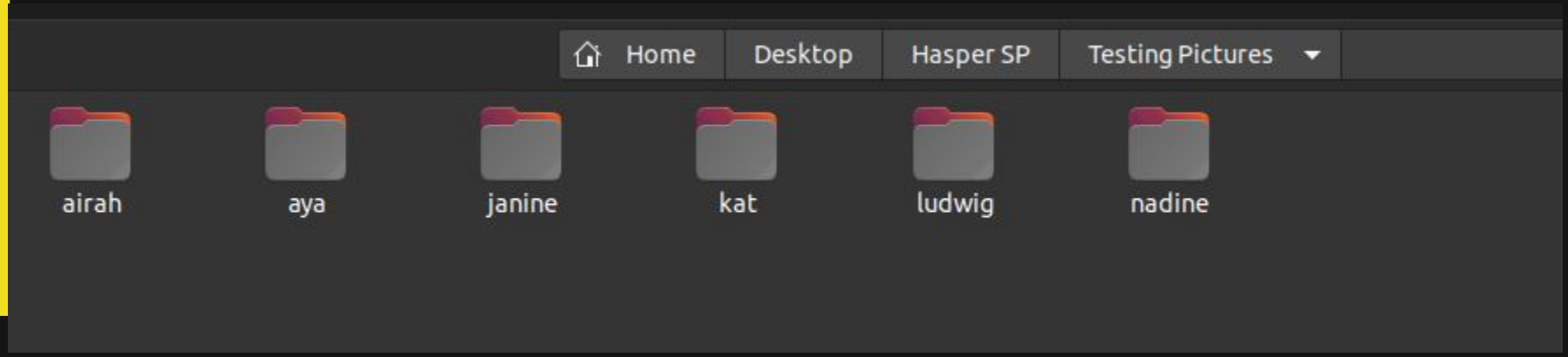


Methodology

10 images per day, 6 classes

10 data augmentation methods

600 images per day



Methodology

CNN Architecture

- 3 Convolutional Layers
  - 64 input nodes
  - 3x3 window size
  - Rectified Linear
  - Pooling of 2x2 pool size
- Dense Layer
  - Softmax Activation

Methodology

RNN Architecture

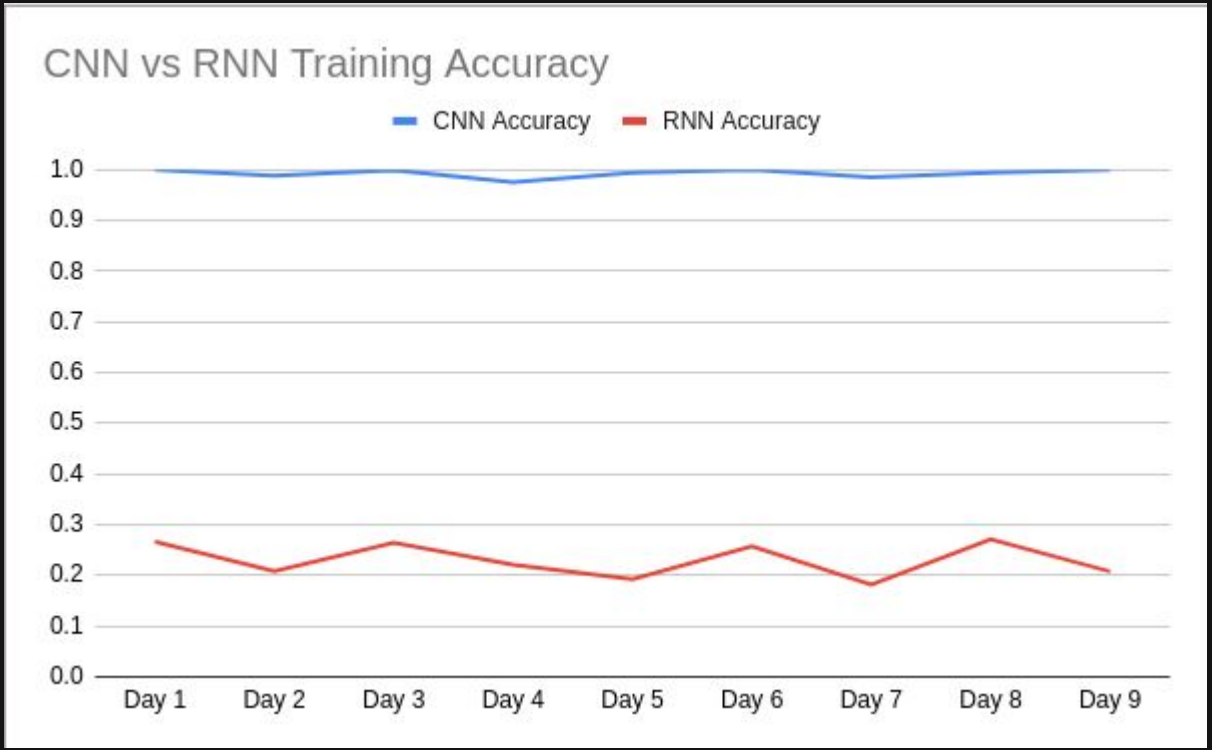
- 2 Long Short Term Memory layer
  - 64 input nodes
  - 30% Dropout
- Dense Layer
  - Softmax Activation

Methodology

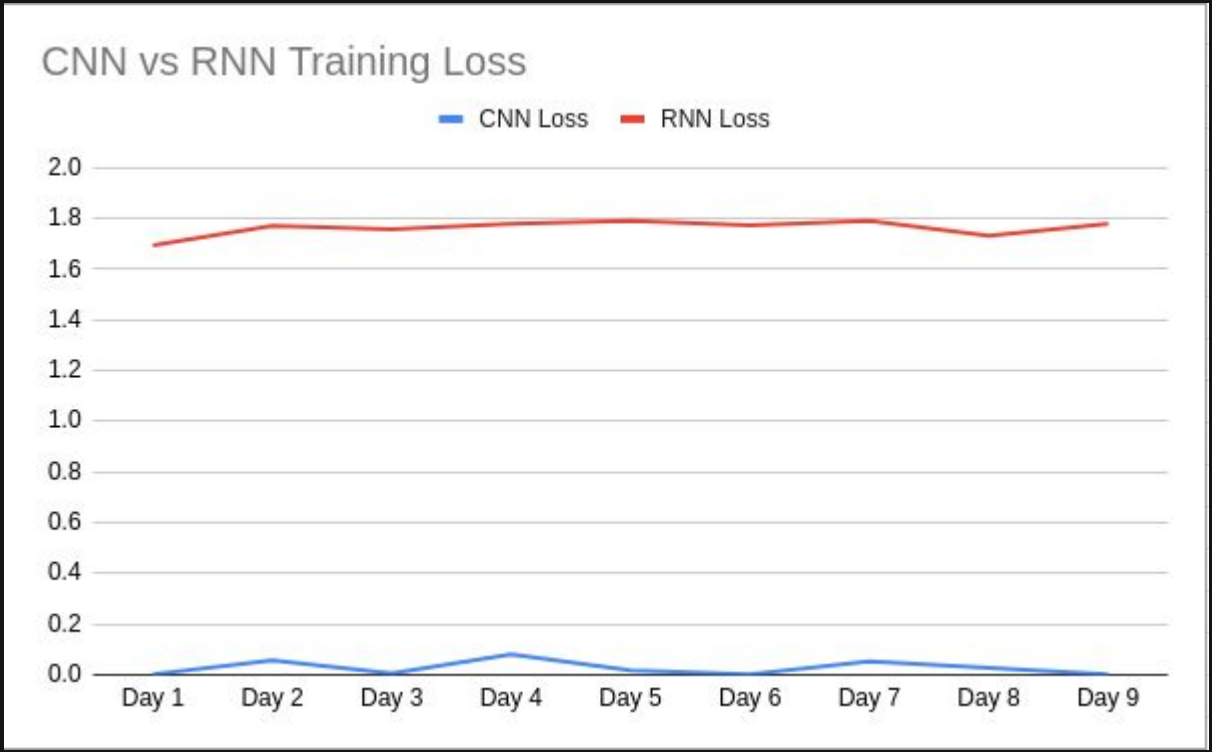
Training Method

- 1000 epochs
- Batch Size 16
- Early Stopping monitoring Val Loss
  - Patience of 8
- 10% Validation Split

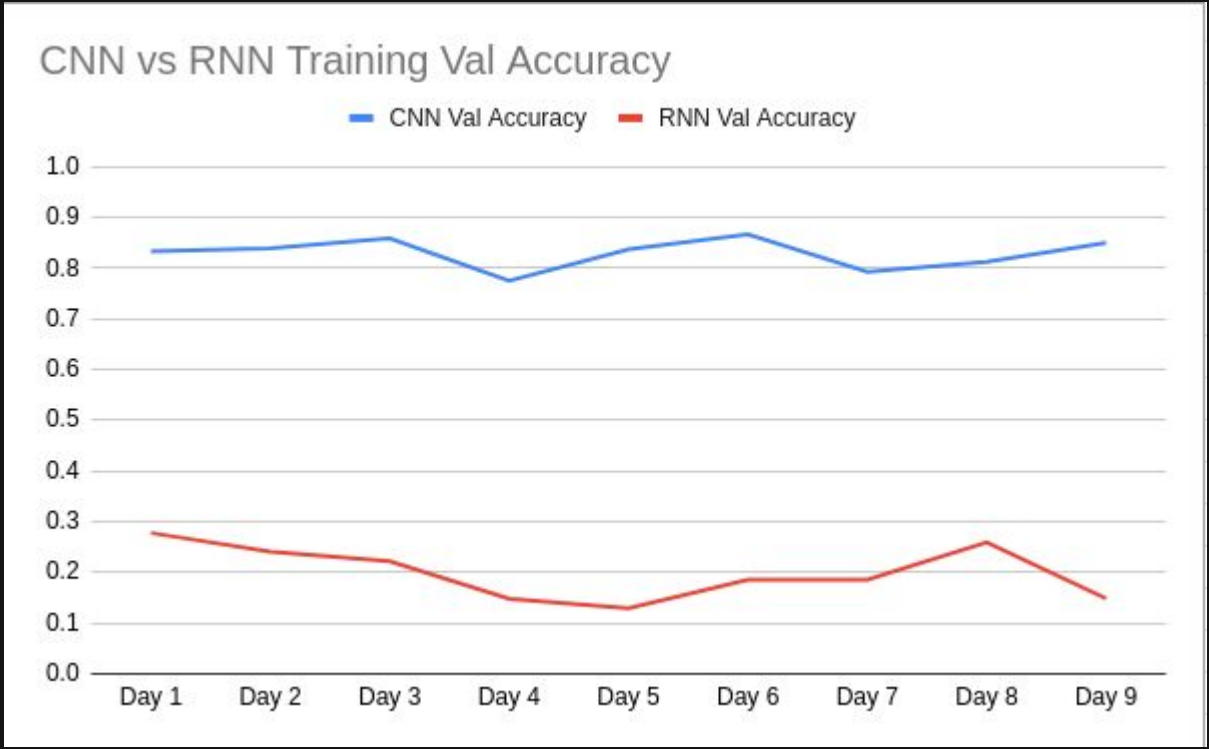
Results


CNN vs RNN Training Accuracy
CNN Accuracy
RNN Accuracy
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9

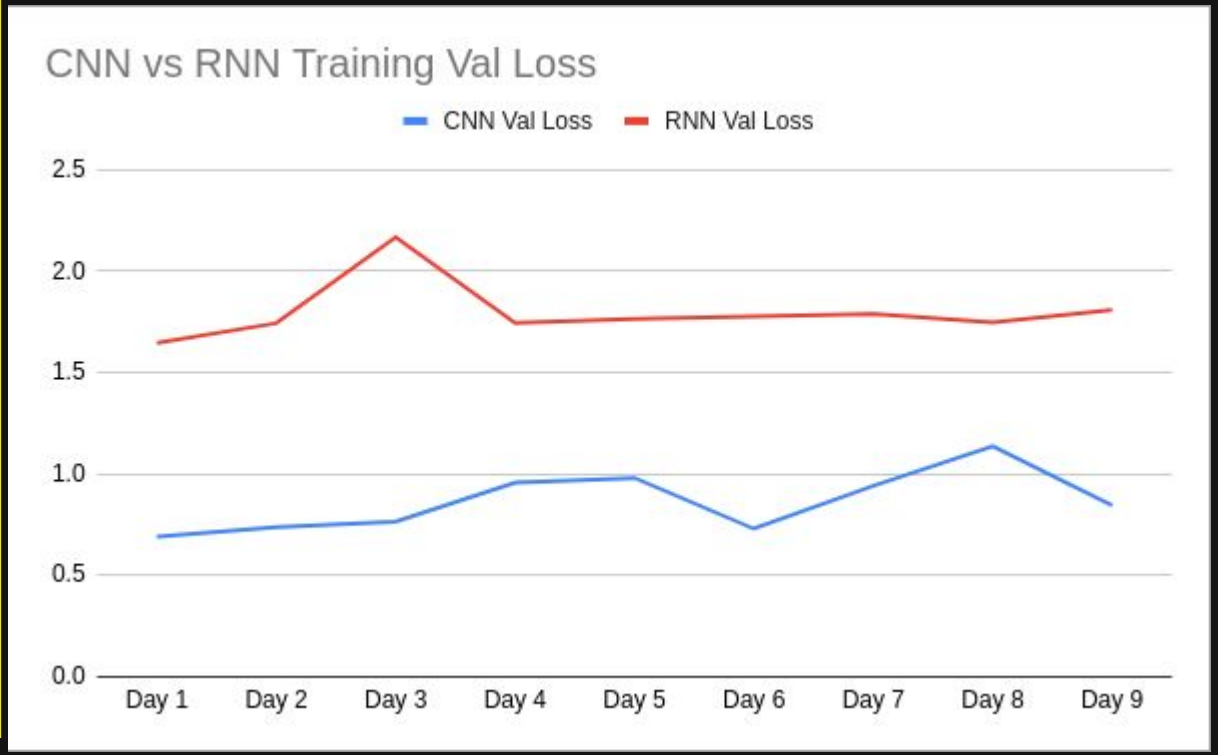
Results


CNN vs RNN Training Loss
CNN Loss
RNN Loss
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9

Results


CNN vs RNN Training Val Accuracy
CNN Val Accuracy
RNN Val Accuracy
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9

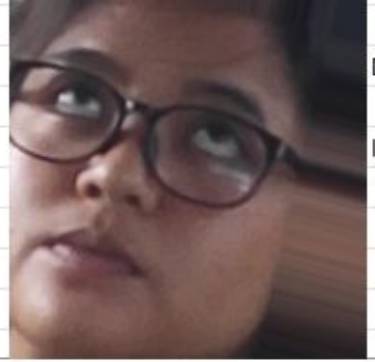
Results


CNN vs RNN Training Val Loss
CNN Val Loss
RNN Val Loss
2.5
2.0
1.5
1.0
0.5
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9

Results

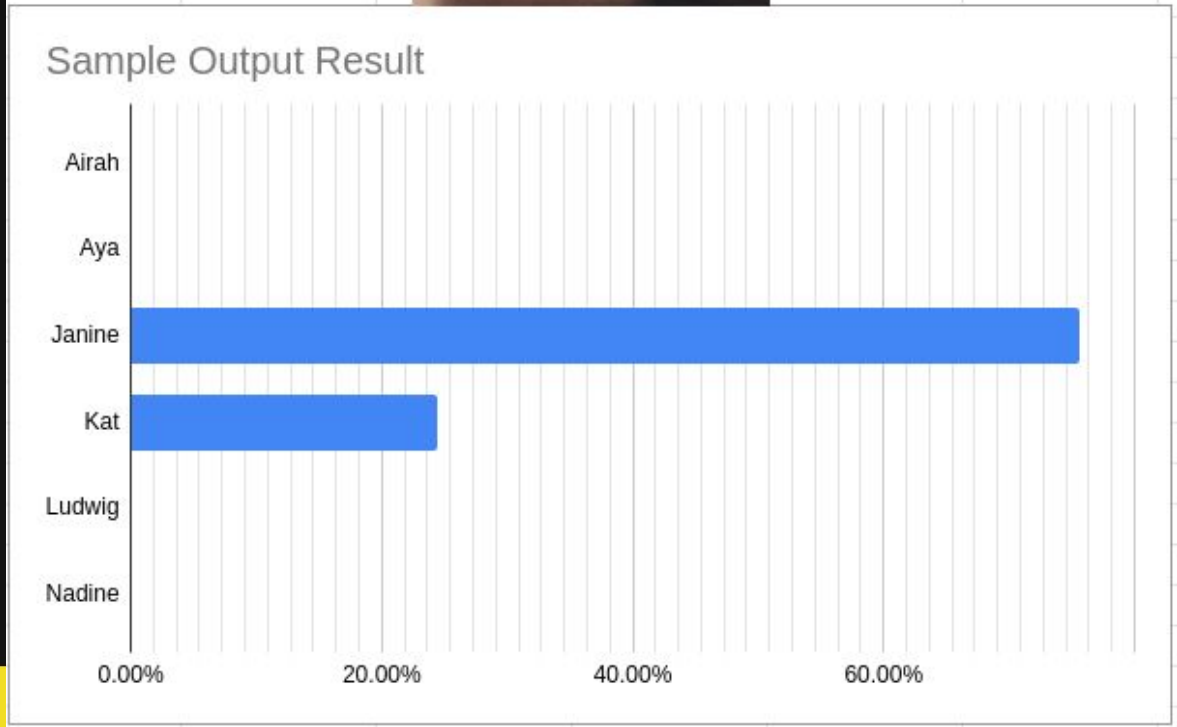
```
Currently testing: janine
[1.0257115e-09 1.8587325e-07 7.5598693e-01 2.4401288e-01 4.6671472e-13
 2.6252200e-15]
janine1590429625_0_7168.png is 0.7559869% sure that it is janine
```

Results

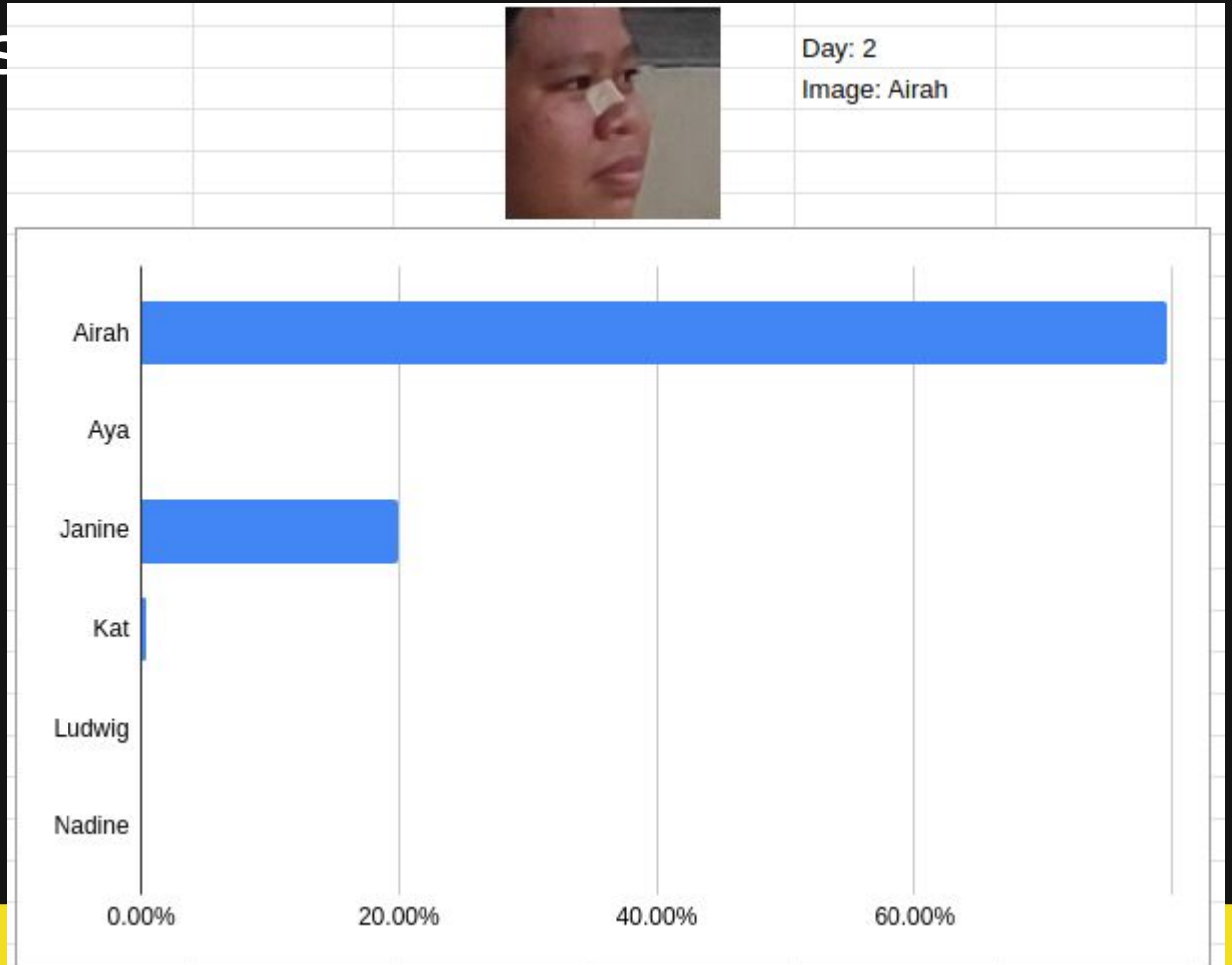


Day: 3

Image: Janine



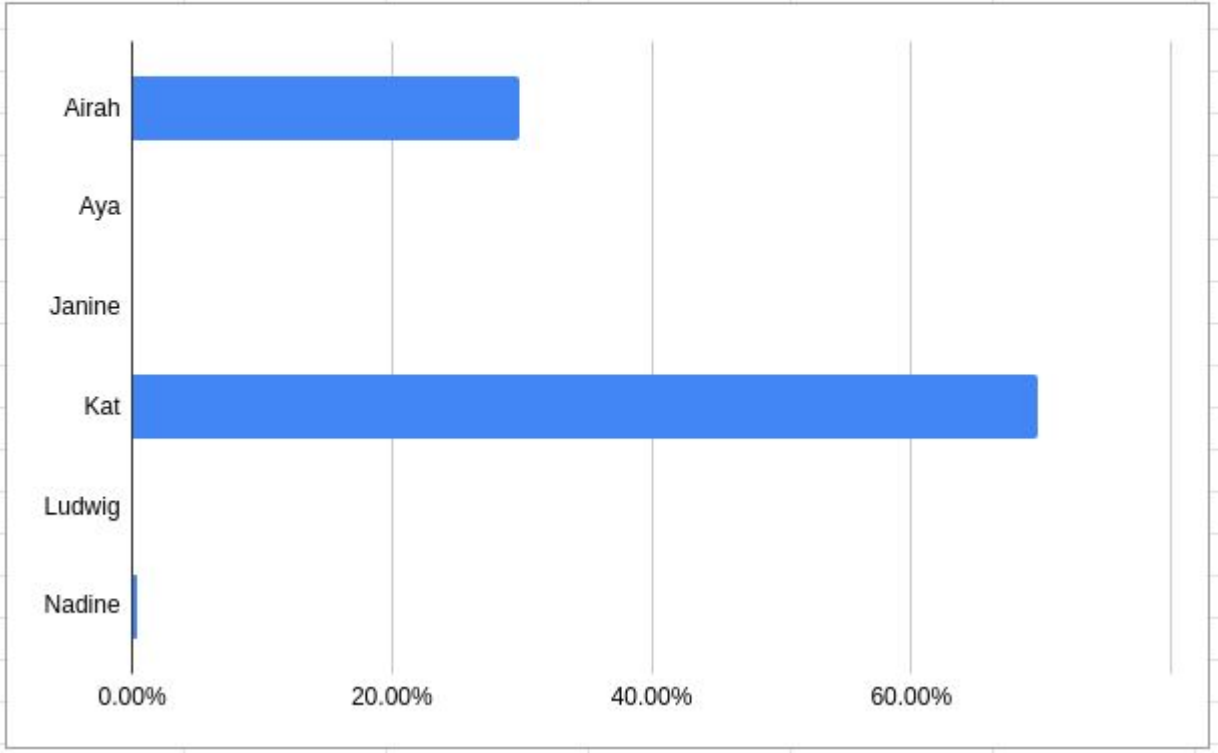
Results


Day: 2
Image: Airah
Airah
Aya
Janine
Kat
Ludwig
Nadine
0.00%
20.00%
40.00%
60.00%

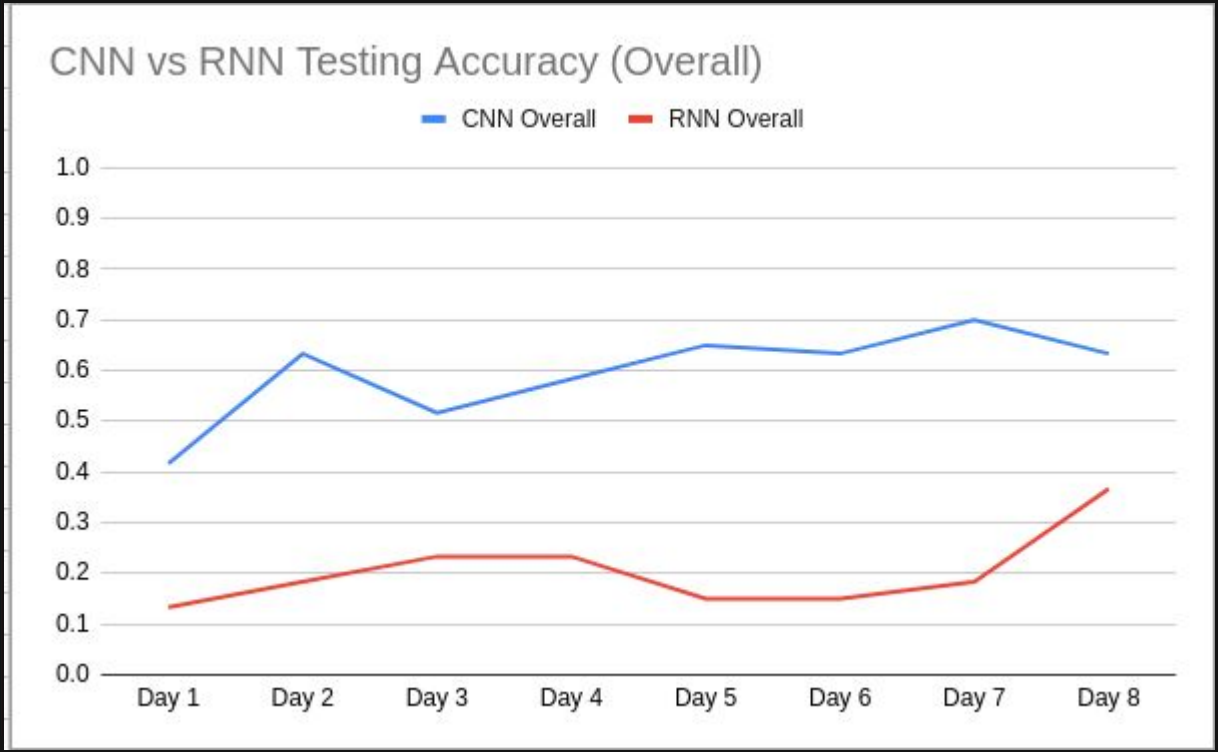
Results

Day: 2

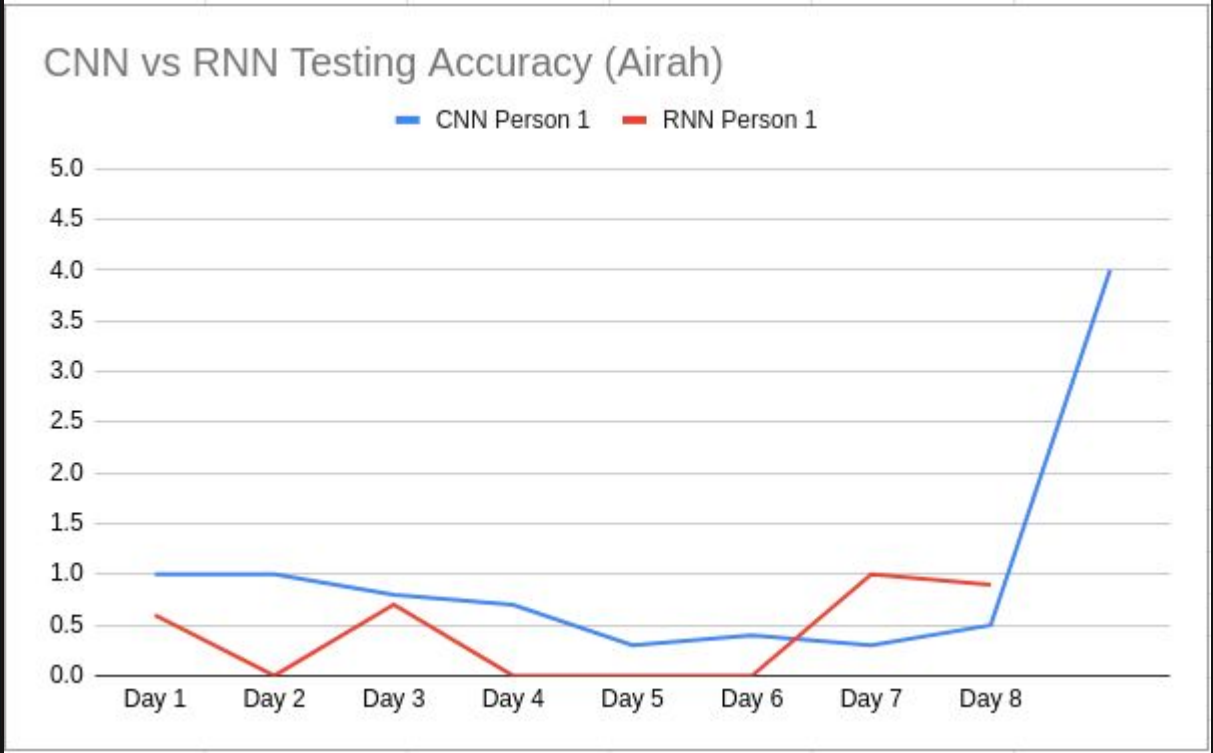
Image: Aya



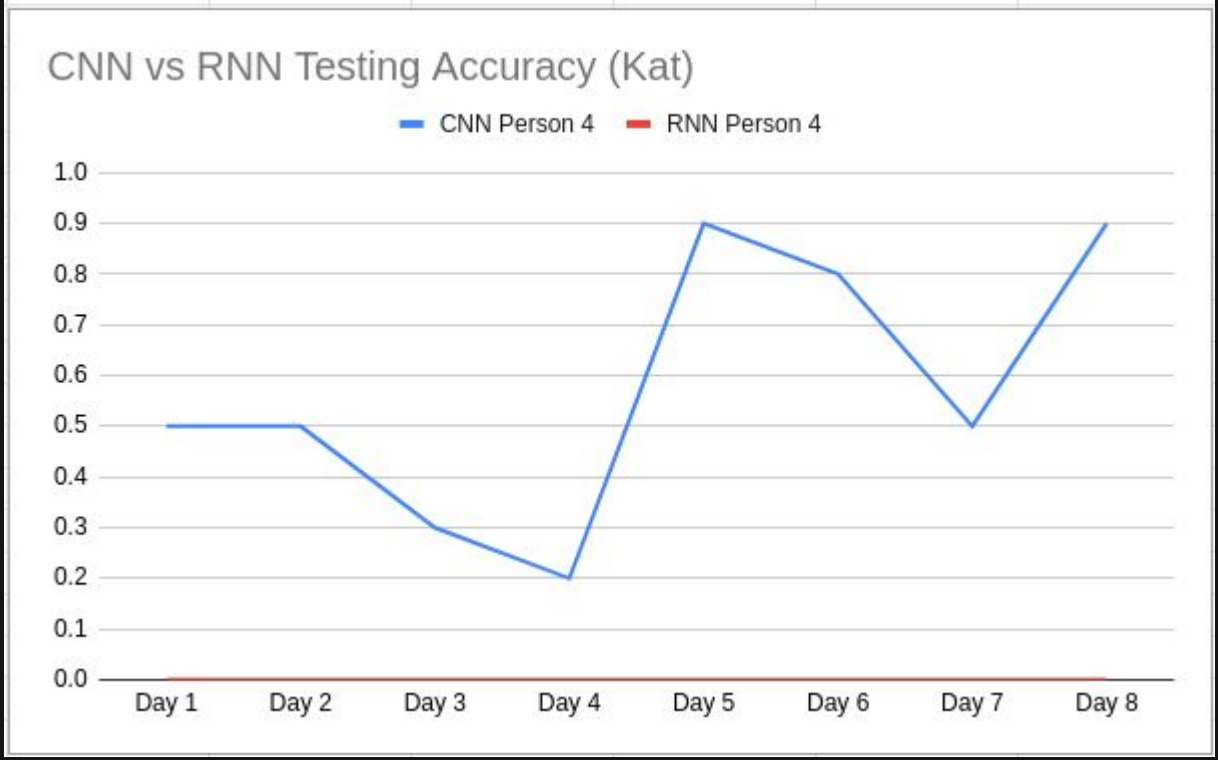
Results


CNN vs RNN Testing Accuracy (Overall)
CNN Overall
RNN Overall
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8

Results


CNN vs RNN Testing Accuracy (Airah)
CNN Person 1
RNN Person 1
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8

Results


CNN vs RNN Testing Accuracy (Kat)
CNN Person 4
RNN Person 4
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8

Confusion Matrix

RNN Day 1 Result

	Airah	Aya	Janine	Kat	Ludwig	Nadine
Airah	0	0	0	5	0	5
Aya	0	1	1	2	0	6
Janine	0	4	0	6	0	0
Kat	0	1	0	9	0	0
Ludwig	0	0	0	5	0	5
Nadine	0	0	0	6	0	4

Confusion Matrix

RNN Day 4 Result

	Airah	Aya	Janine	Kat	Ludwig	Nadine
Airah	0	9	1	0	0	0
Aya	0	5	2	0	1	0
Janine	0	7	0	0	3	0
Kat	0	6	0	0	4	0
Ludwig	0	6	1	0	3	0
Nadine	0	9	1	0	0	0

CNN Attendance Results

	Airah	Aya	Janine	Kat	Ludwig	Nadine
Day 1	1	0.1	0.2	0.5	0	0.7
Day 2	1	0	1	0.5	0.6	0.7
Day 3	0.8	0.8	0	0.3	0.7	0.5
Day 4	0.7	0.5	0.6	0.2	0.7	0.8
Day 5	0.3	0.2	0.8	0.9	0.7	1
Day 6	0.4	0.5	0.5	0.8	0.6	1
Day 7	0.3	0.9	0.7	0.5	1	0.8
Day 8	0.5	0.4	0.5	0.9	0.5	1

RNN Attendance Results

	Airah	Aya	Janine	Kat	Ludwig	Nadine
Day 1	0.6	0	0	0	0	0.2
Day 2	0	0	0.3	0	0	0.8
Day 3	0.7	0	0.1	0	0.1	0.5
Day 4	0	0.6	0	0	0.8	0
Day 5	0	0.1	0.6	0	0	0.2
Day 6	0	0.4	0.3	0	0	0.2
Day 7	1	0	0	0	0.1	0
Day 8	0.9	0.3	0	0	1	0

Out of Class Pictures

	CNN	RNN
Airah	0.3333333333	1
Aya	0.3333333333	0
Janine	0	0
Kat	0	0
Ludwig	0.6666666667	0
Nadine	0	0
Overall	0.2222222222	0.1666666667

Discussion

- CNN outperforms RNN in image classification
- Both CNN and RNN provided insufficient accuracy rate
- RNN is not feasible for the use-case scenario at hand
- CNN may reach at least 90% accuracy on testing beyond day 8

Conclusion

- Attendance checking of CNN and RNN per person shows false absences
- CNN may reach 90% after day 8 but it is not worth skipping 8 meetings of attendance
- RNN predicted only one to two persons completely thus not feasible
- CNN model at hand is not optimal for the scenario but cannot be concluded as not feasible

Recommendation

- Further testing of CNN with different number of layers, nodes, etc.
- Number of pictures taken per lecture
- Different poses with a higher degree of freedom
- Video input instead of still images

Thank You!