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

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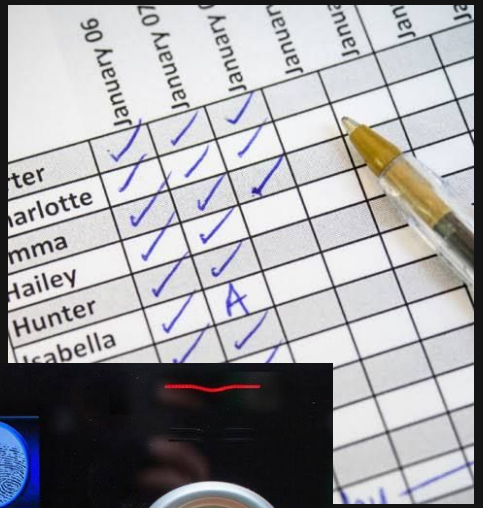
Background of the Study

Hassle on Attendance Checking

Alternatives



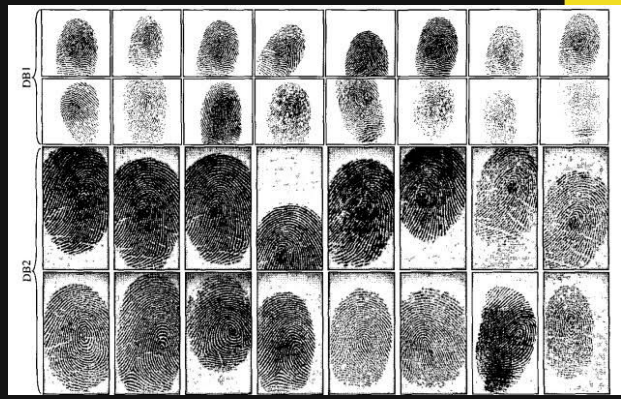
Background of the Study

- Smartphone Camera Quality
- Face Detection Technological Advancements

Problem

Database for Face Recognition

or Any Recognition Algorithms



Solution

Compare the better Neural Network to Use Given Constraints

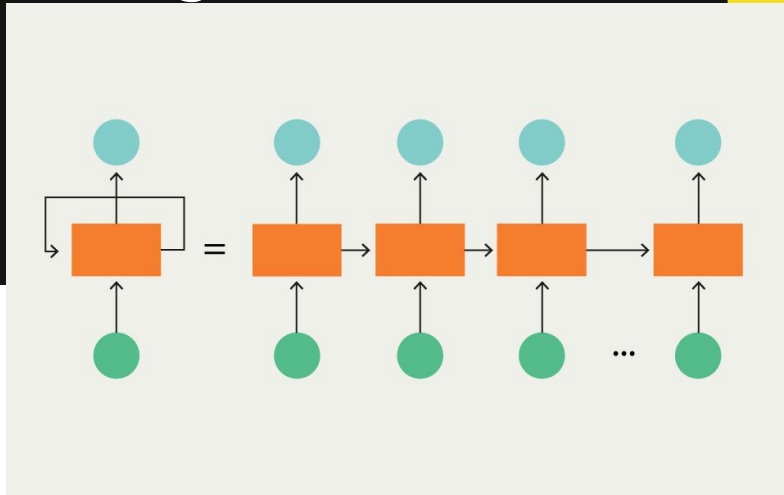
- No global database
- Training will be done concurrently with the lecture

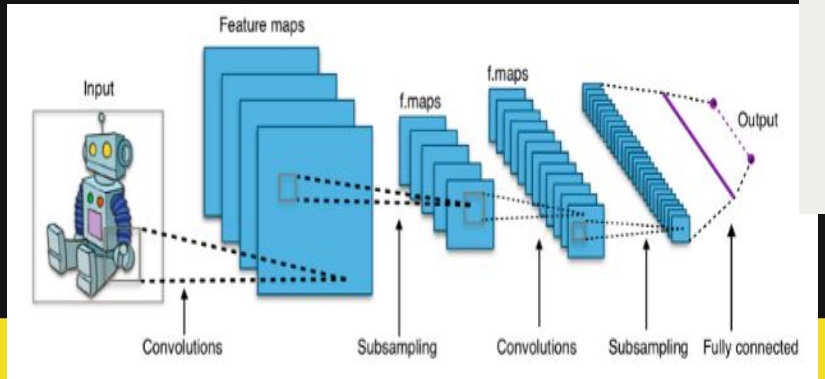
Objectives

Compare CNN and RNN performance given

No pre-existing data set

Limited data set



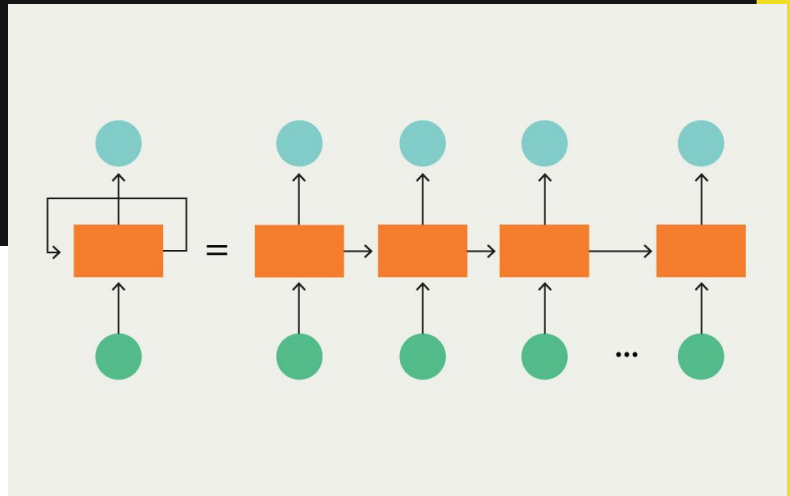


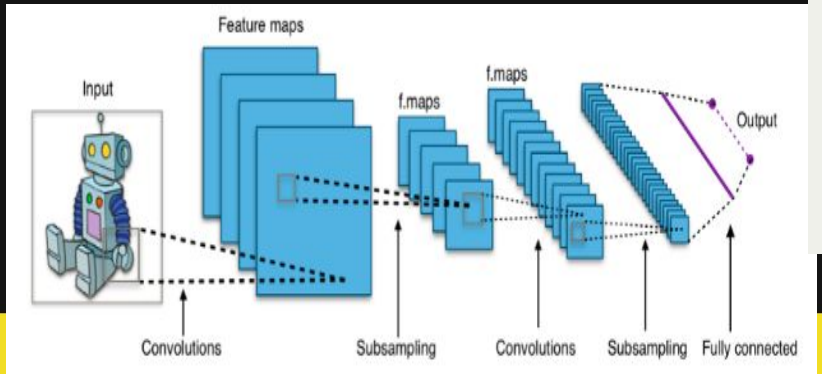
Objectives

CNN - Well-known for image classification

RNN - Event prediction, but sometimes

Used in face recognition





Objectives

- create face data sets using face detection libraries given a classroom image
- design respective neural network models that will learn from the per meeting data set
- evaluate the accuracy of the models using a data set from the following meeting
- repeat all procedures until the end of the semester
- evaluate the overall performance of the model

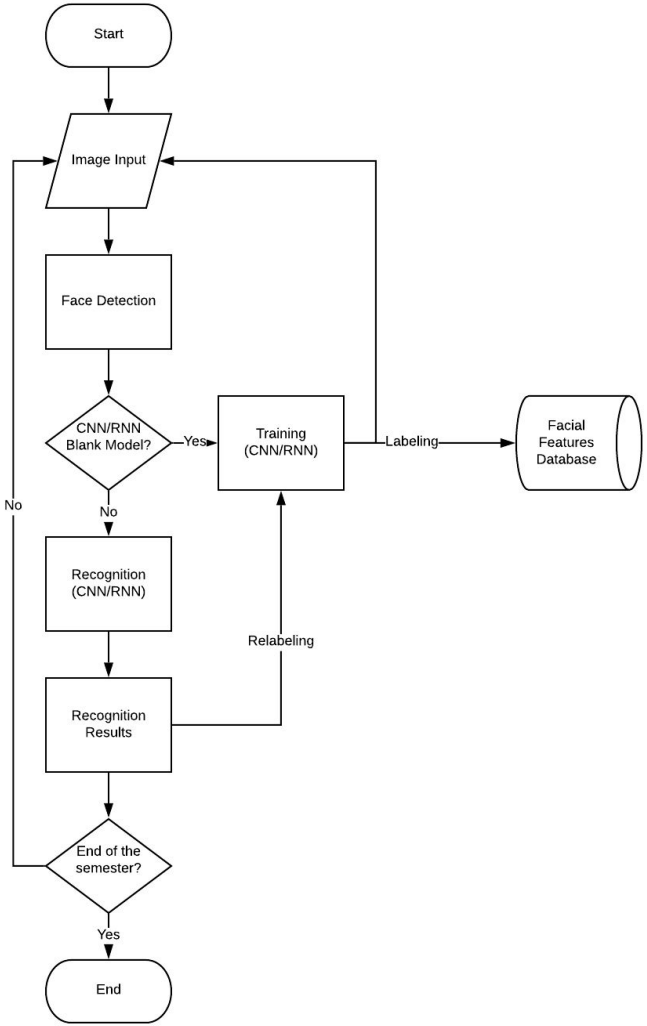
Methodology

Image Input

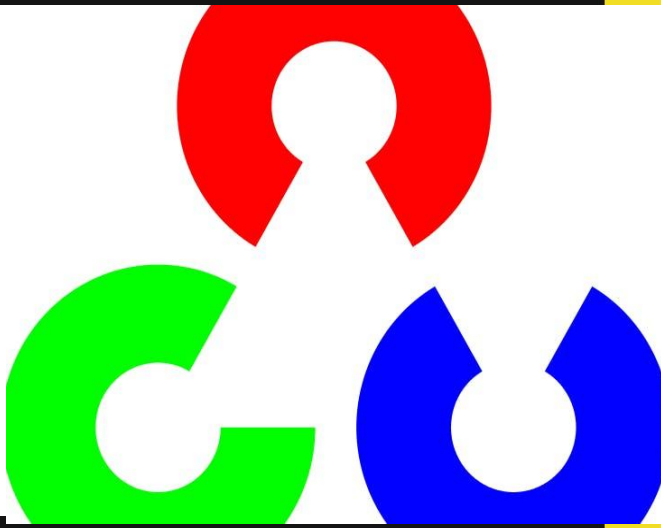
Face Detection

Training and Recognition

Recognition Results



Methodology

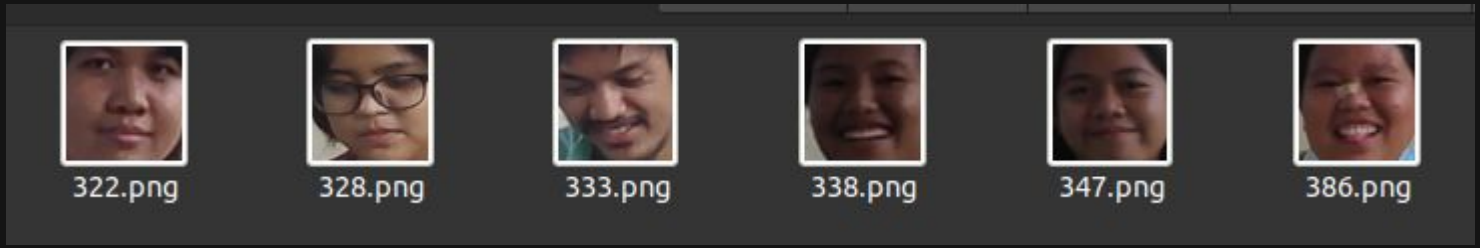


Met

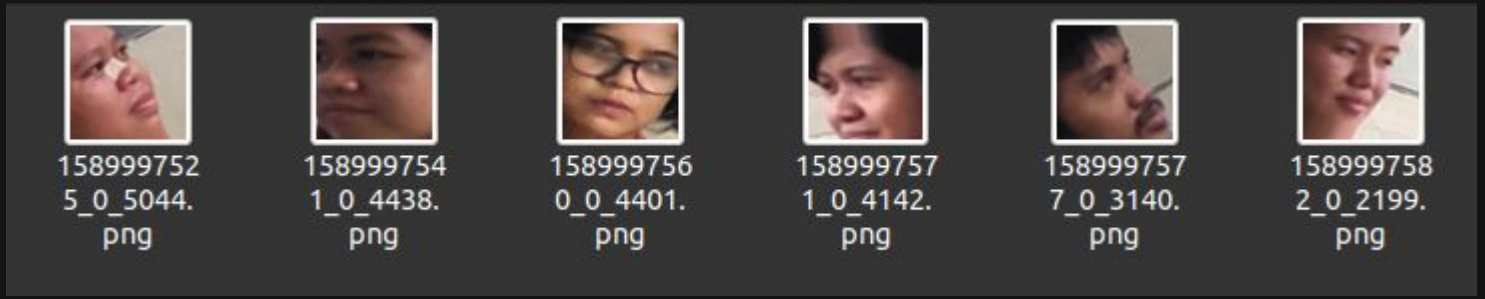

NO SMOKING
BATONG MALAKE
CARES
NO LITTERING
BATONG MALAKE
CARES

Methodology

Detected Faces



Augmented Faces

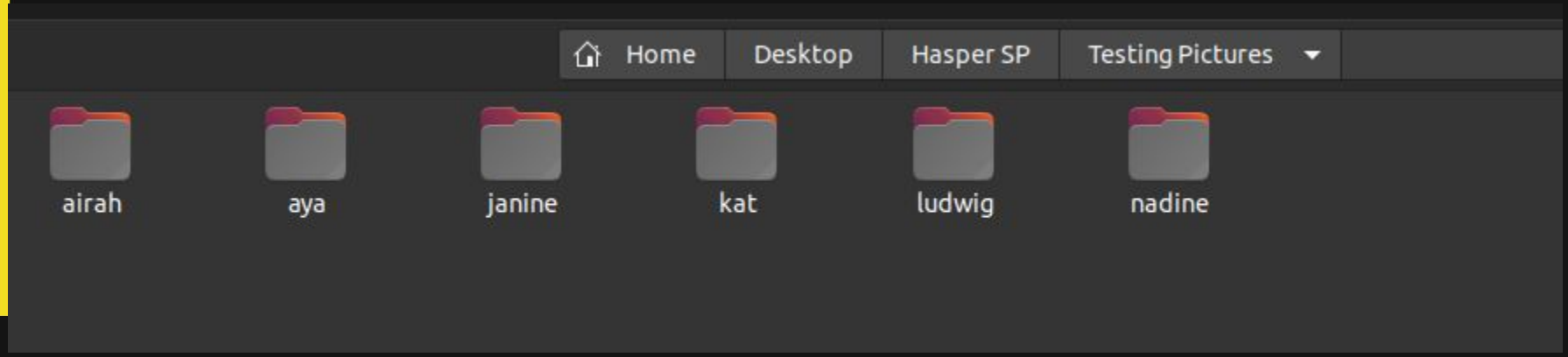


Methodology

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

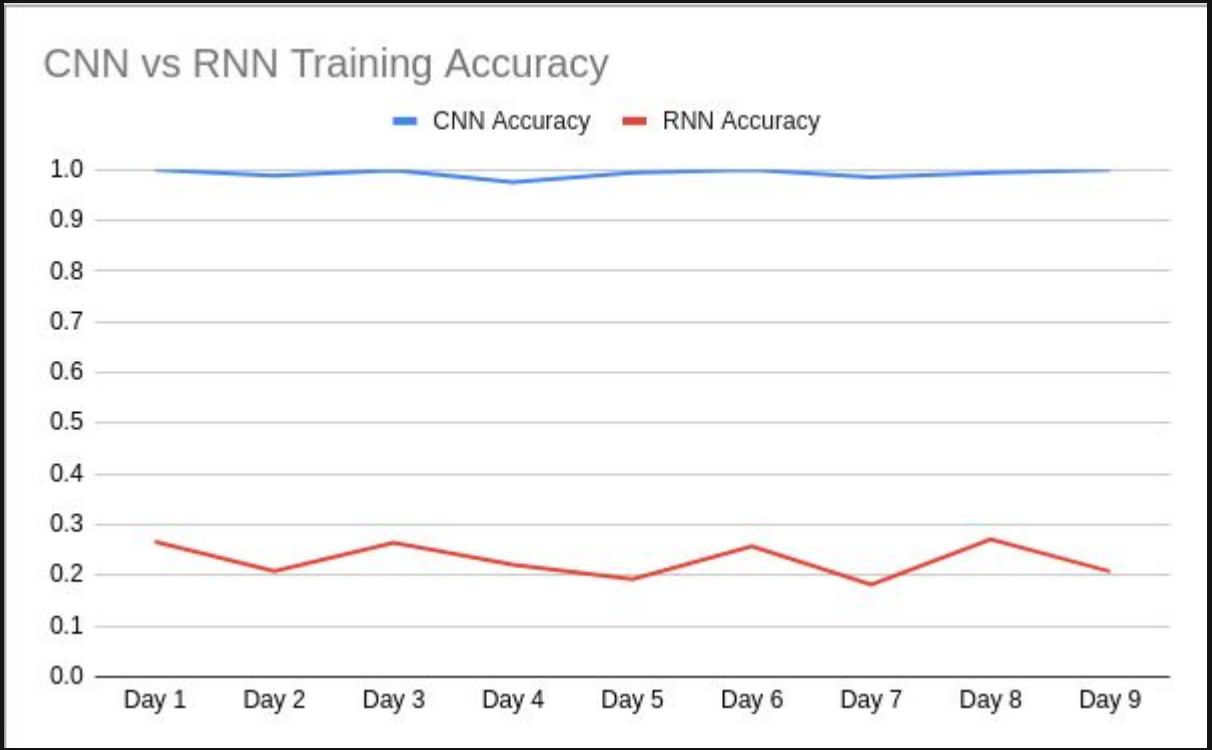
- 2 Long Short Term Memory layer
  - 64 input nodes
  - 30% Dropout
- Dense Layer
  - Softmax Activation

Methodology

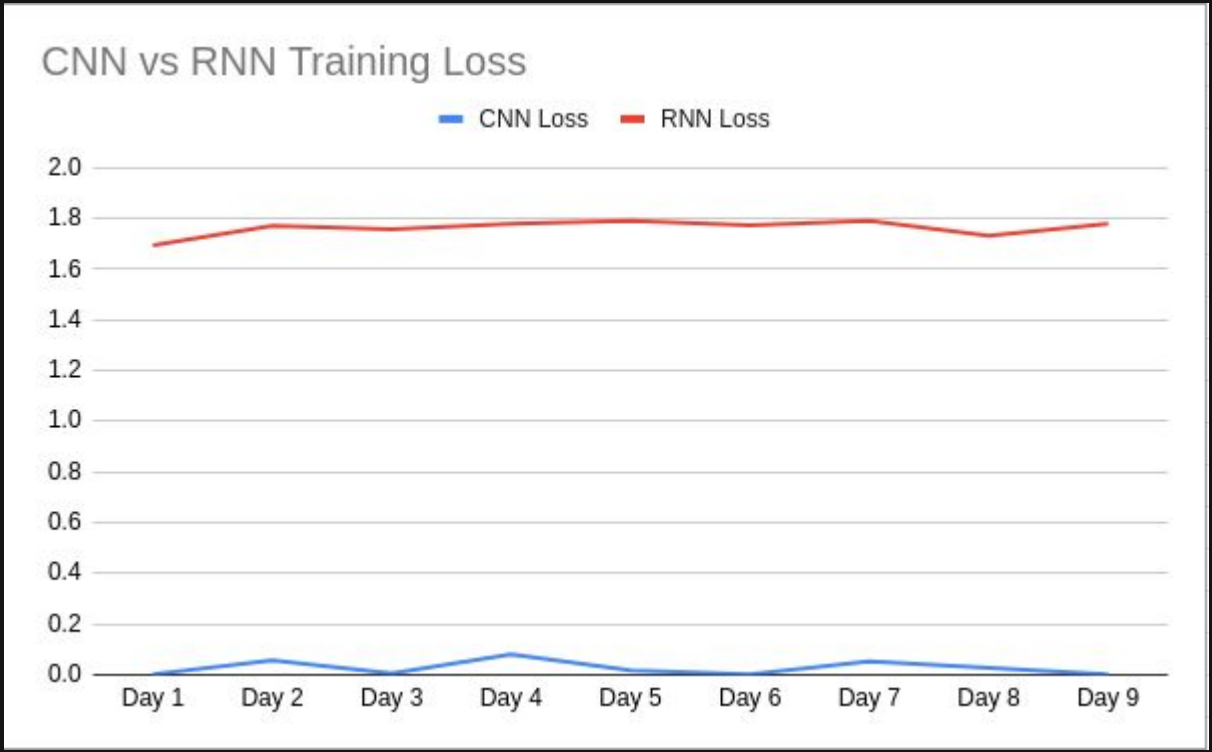
Training Method

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

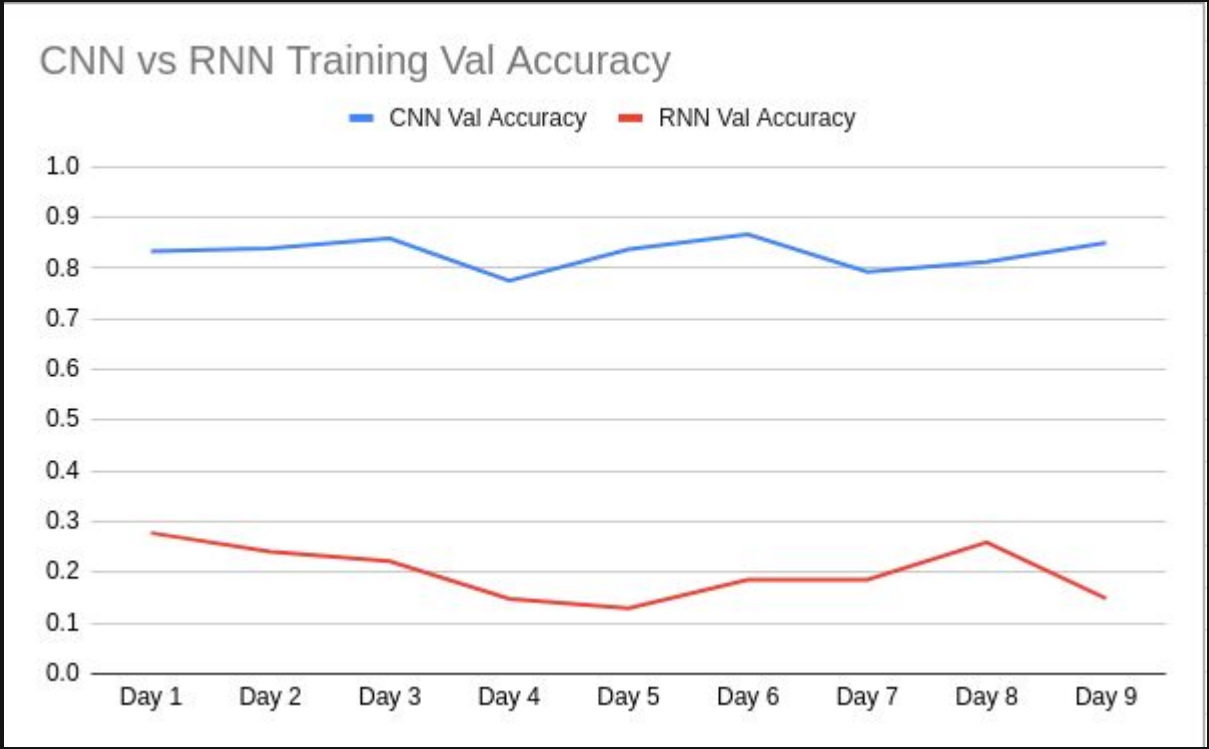
Results


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

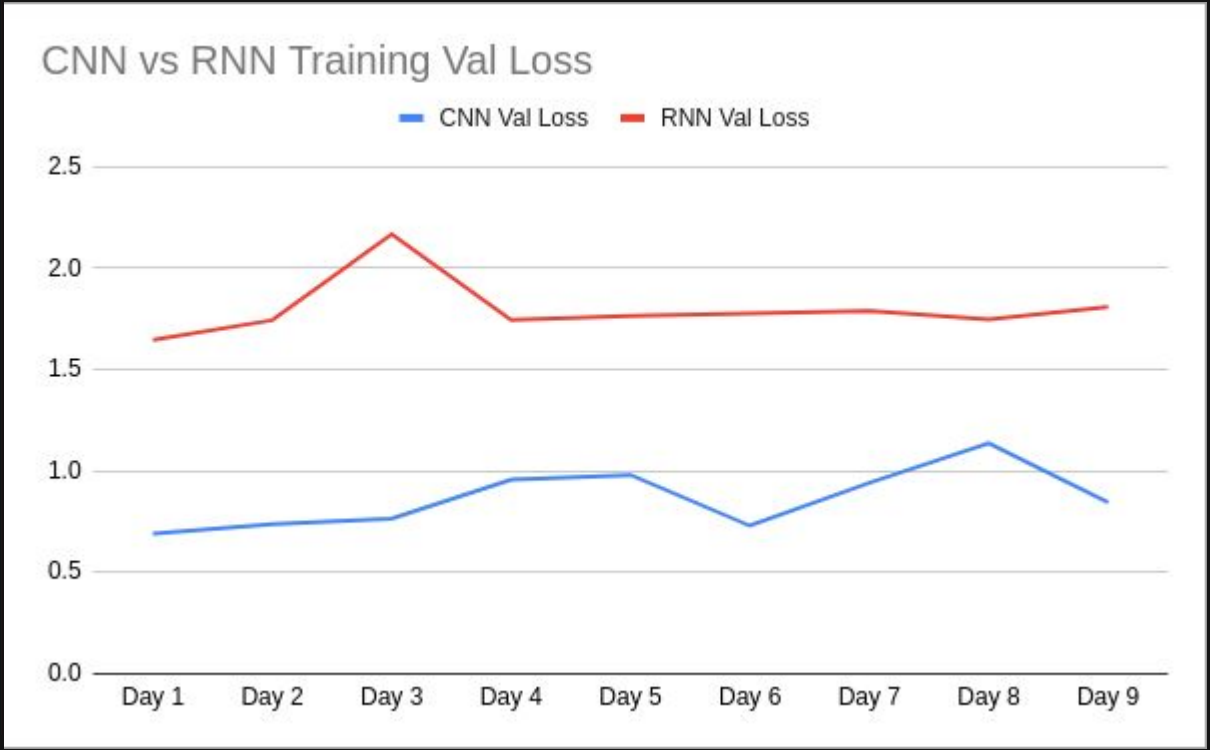
Results


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

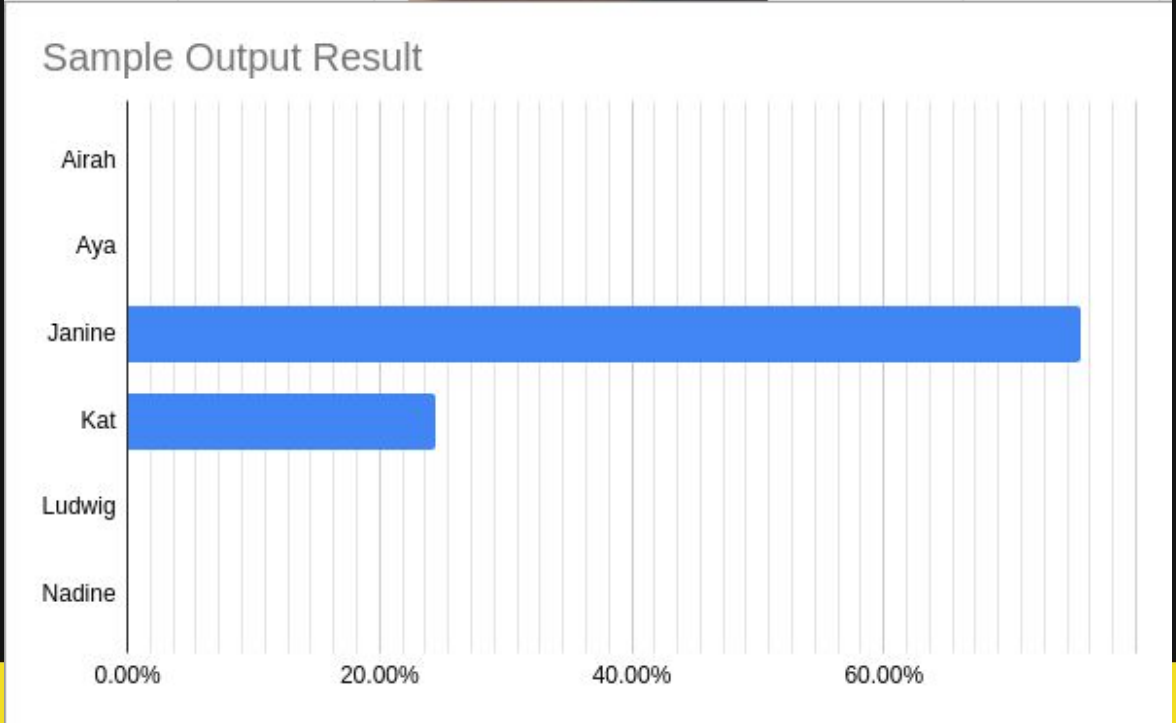
Results


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

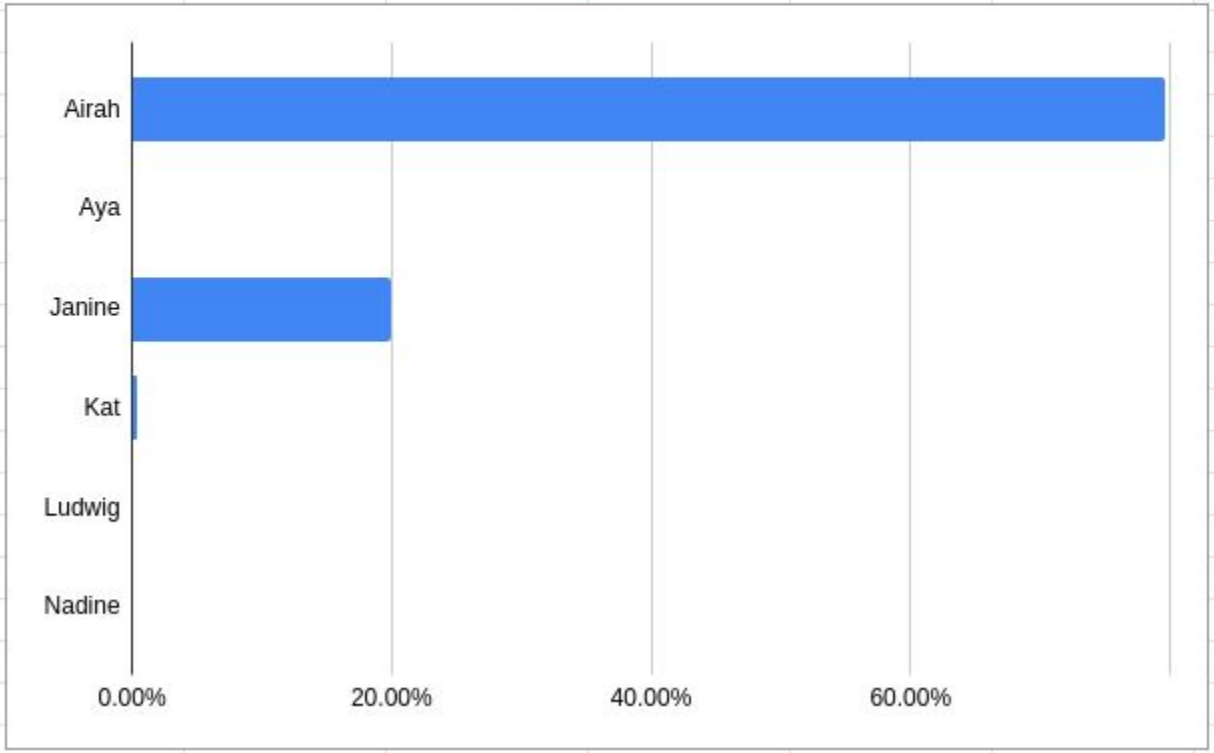
Results

```
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
```

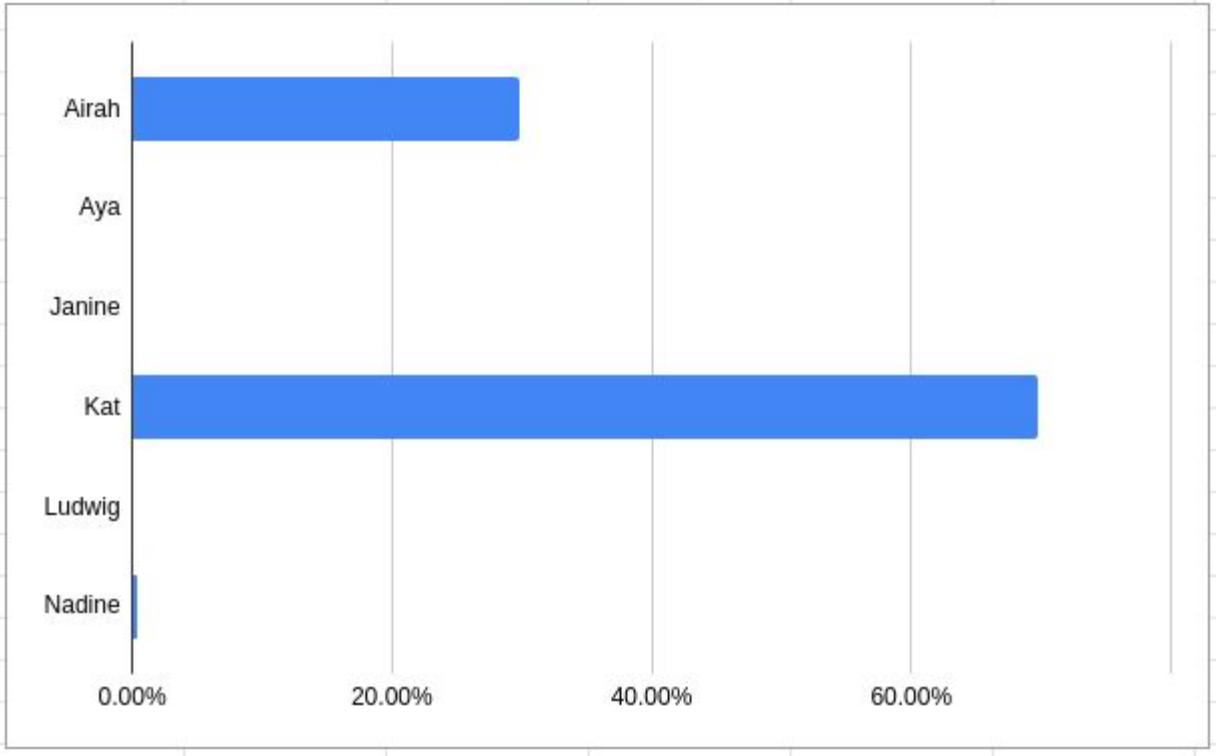
Results


Sample Output Result
Airah
Aya
Janine
Kat
Ludwig
Nadine
0.00%
20.00%
40.00%
60.00%

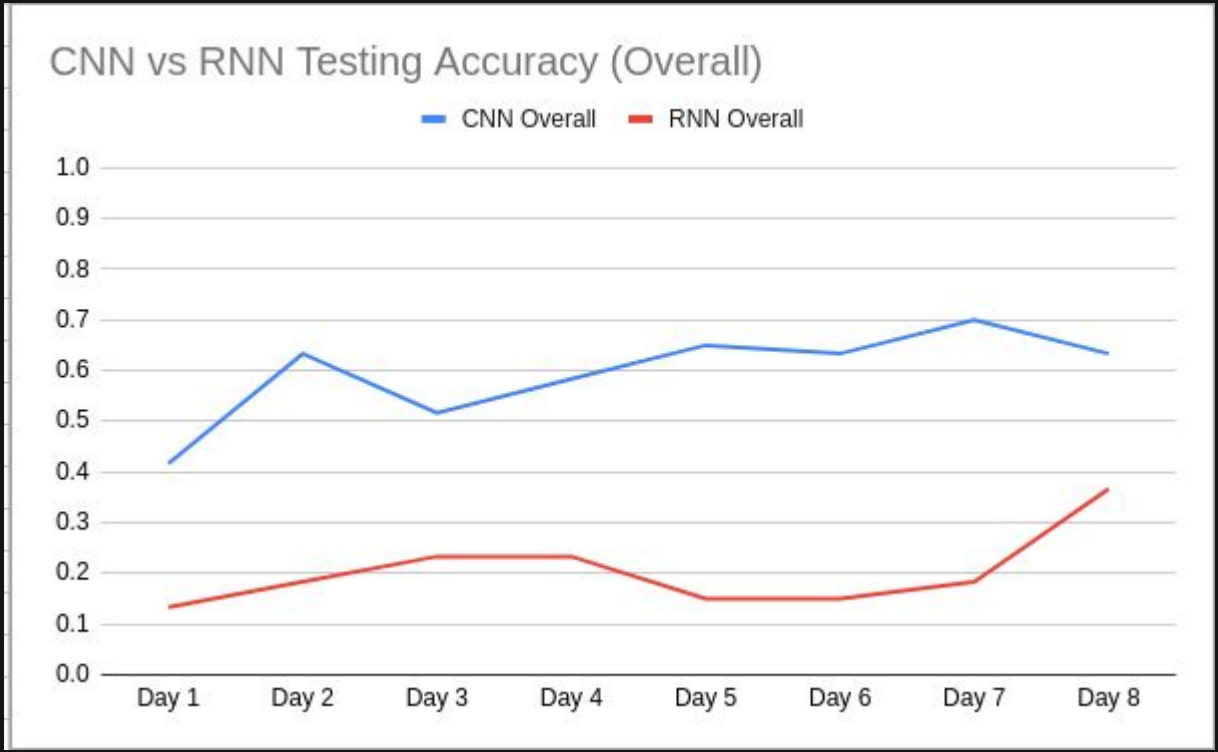
Results



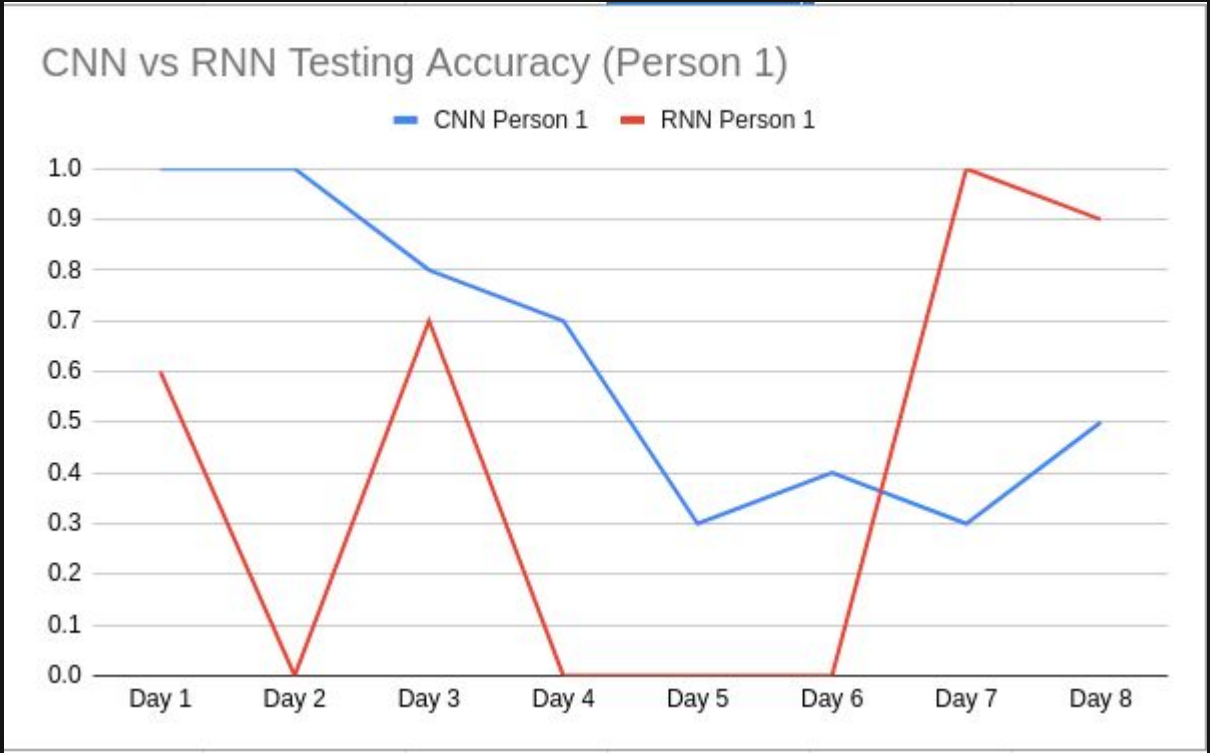
Results



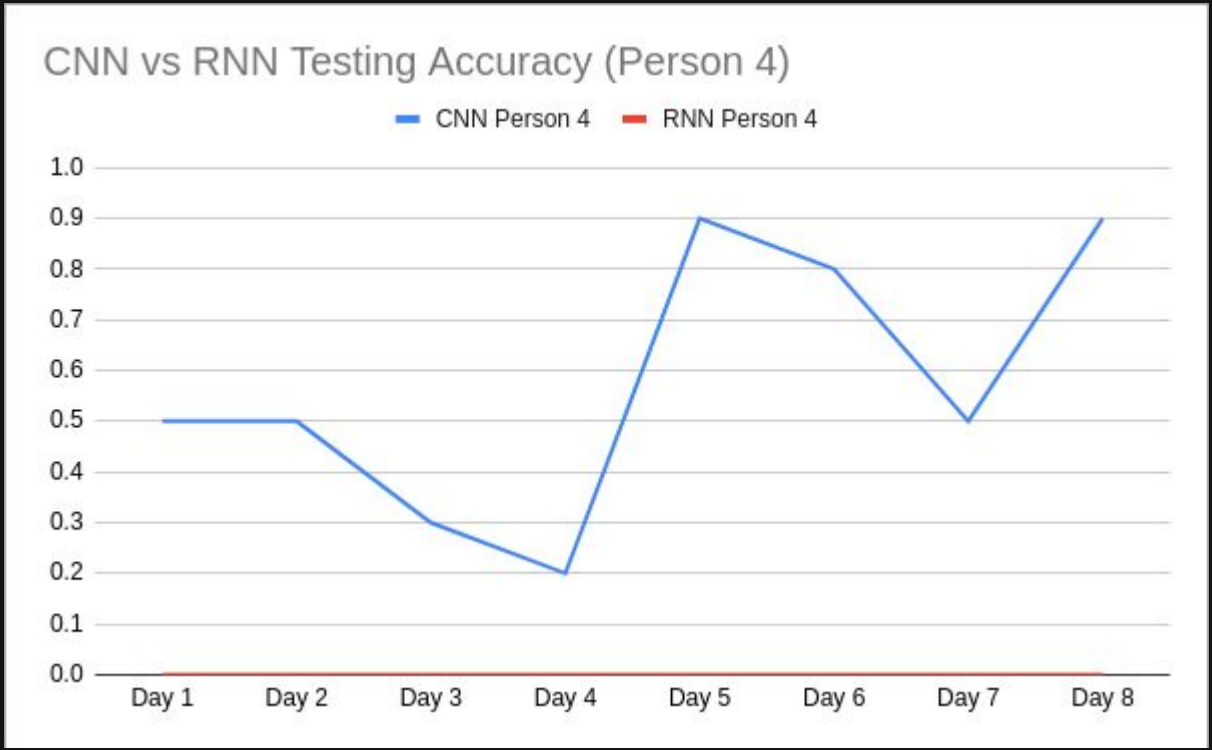
Results


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 (Person 1)
CNN Person 1
RNN Person 1
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 (Person 4)
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

Day 1

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	10	0	0	0	0	0
Person 2	6	1	0	1	0	2
Person 3	0	2	2	2	0	4
Person 4	0	1	0	5	0	4
Person 5	6	0	1	0	0	3
Person 6	3	0	0	0	0	7

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	0	0	0	5	0	5
Person 2	0	1	1	2	0	6
Person 3	0	4	0	6	0	0
Person 4	0	1	0	9	0	0
Person 5	0	0	0	5	0	5
Person 6	0	0	0	6	0	4

Day 2

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	10	0	0	0	0	0
Person 2	0	0	10	0	0	0
Person 3	0	0	10	0	0	0
Person 4	0	0	2	5	1	2
Person 5	0	0	3	1	6	0
Person 6	0	2	0	0	1	7

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	0	2	5	0	0	3
Person 2	0	1	8	0	0	1
Person 3	0	1	8	0	0	1
Person 4	0	0	5	2	0	3
Person 5	0	2	4	0	0	2
Person 6	0	3	6	0	0	1

Day 3

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	8	0	0	2	0	0
Person 2	1	8	0	0	1	0
Person 3	0	3	0	2	1	4
Person 4	1	6	0	3	0	0
Person 5	1	1	0	0	7	1
Person 6	0	4	0	1	0	5

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	6	0	0	0	0	4
Person 2	4	0	3	0	0	3
Person 3	5	0	3	0	0	2
Person 4	4	0	1	0	0	5
Person 5	1	0	0	0	0	9
Person 6	2	0	1	0	0	7

Confusion Matrix

Day 4

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	7	2	1	0	0	0
Person 2	1	5	1	1	1	1
Person 3	1	0	6	2	0	1
Person 4	0	2	1	2	0	5
Person 5	0	1	0	1	7	1
Person 6	0	1	0	0	1	8

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	0	9	1	0	0	0
Person 2	0	5	2	0	1	0
Person 3	0	7	0	0	3	0
Person 4	0	6	0	0	4	0
Person 5	0	6	1	0	3	0
Person 6	0	9	1	0	0	0

Day 5

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	3	2	4	0	0	1
Person 2	0	2	1	3	2	2
Person 3	0	1	8	0	0	1
Person 4	0	0	1	9	0	0
Person 5	0	0	2	1	7	0
Person 6	0	0	0	0	0	10

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	0	0	8	2	0	0
Person 2	1	0	1	0	1	7
Person 3	2	0	5	0	0	3
Person 4	0	2	5	1	0	2
Person 5	4	0	4	0	0	2
Person 6	0	0	5	0	0	5

Day 6

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	4	1	1	0	1	3
Person 2	3	5	0	0	0	2
Person 3	0	3	5	1	0	1
Person 4	0	0	1	8	1	0
Person 5	0	3	1	0	6	0
Person 6	0	0	0	0	0	10

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	0	2	7	0	0	1
Person 2	0	2	5	0	0	3
Person 3	0	4	4	0	0	2
Person 4	0	4	2	0	0	4
Person 5	0	2	0	0	0	8
Person 6	0	3	4	0	0	3

Confusion Matrix

Day 7

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	3	2	4	0	1	0
Person 2	0	9	0	0	0	1
Person 3	0	0	7	1	2	0
Person 4	0	1	3	5	1	0
Person 5	0	0	0	0	10	0
Person 6	0	0	0	1	1	8

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	10	0	0	0	0	0
Person 2	8	0	2	0	0	0
Person 3	10	0	0	0	0	0
Person 4	10	0	0	0	0	0
Person 5	5	0	5	0	0	0
Person 6	10	0	0	0	0	0

Day 8

CNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	5	0	3	0	2	0
Person 2	0	7	1	1	0	1
Person 3	1	2	3	4	0	0
Person 4	0	0	0	10	0	0
Person 5	0	0	3	4	3	0
Person 6	0	0	0	0	0	10

RNN

	Person 1	Person 2	Person 3	Person 4	Person 5	Person 6
Person 1	8	2	0	0	0	0
Person 2	5	2	0	0	3	0
Person 3	2	5	0	0	3	0
Person 4	7	2	0	0	1	0
Person 5	3	4	0	0	3	0
Person 6	2	3	0	0	5	0

Results

	Days	CNN Person 1	CNN Person 2	CNN Person 3	CNN Person 4	CNN Person 5	CNN Person 6
CNN	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

	Days	RNN Person 1	RNN Person 2	RNN Person 3	RNN Person 4	RNN Person 5	RNN Person 6
RNN	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
Person 1	0.3333333333	1
Person 2	0.3333333333	0
Person 3	0	0
Person 4	0	0
Person 5	0.6666666667	0
Person 6	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!