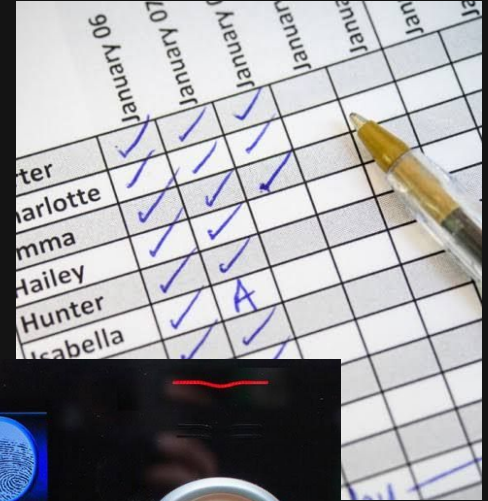# A COMPARATIVE STUDY ON FACIAL RECOGNITION BETWEEN CONVOLUTIONAL NEURAL NETWORK AND RECURRENT NEURAL NETWORK PERFORMANCE

JASPER R. SUNGA

Background of the Study

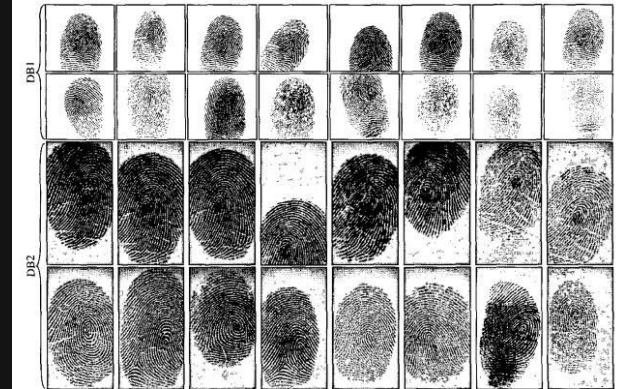Hassle on Attendance Checking

Alternatives

Background of the Study

- Smartphone Camera Quality
- Face Detection Technological Advancements

Problem

Database for Face Recognition

or Any Recognition Algorithms

Solution

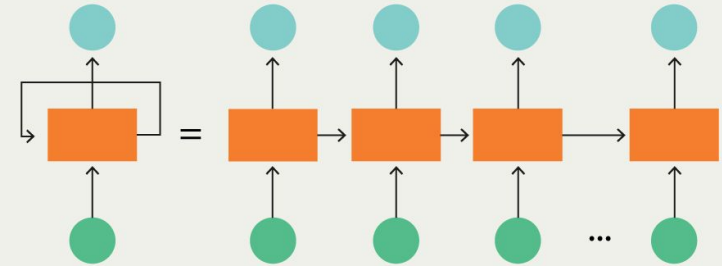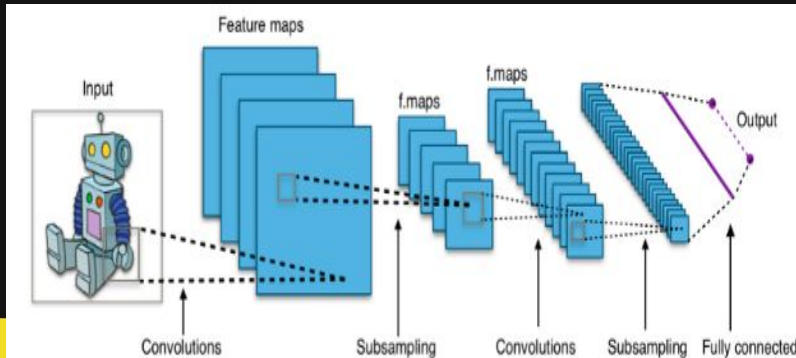Compare the better Neural Network to Use Given Constraints

- 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
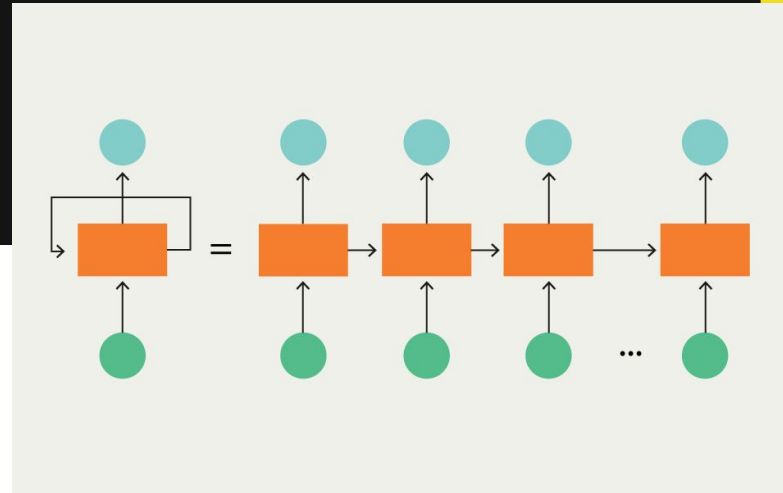
CNN - Well-known for image classification

RNN - Event prediction, but sometimes

Used in face recognition
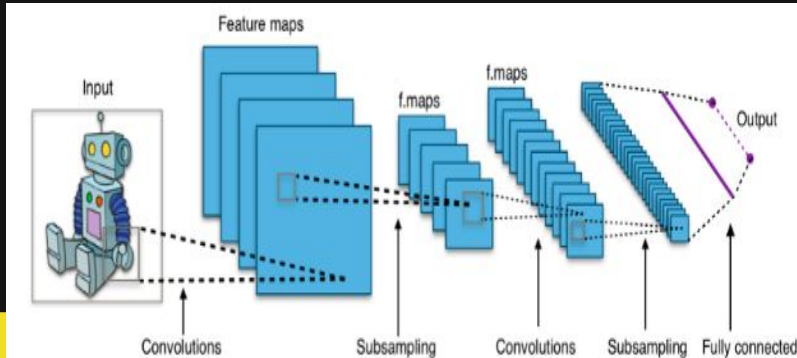
Objectives

- Create database of images per day for the models to train
- Export pictures from database for testing accuracy per day
- Analyze CNN and RNN models' performance

Methodology

Image Input

Face Detection

Training and Recognition

Recognition Results
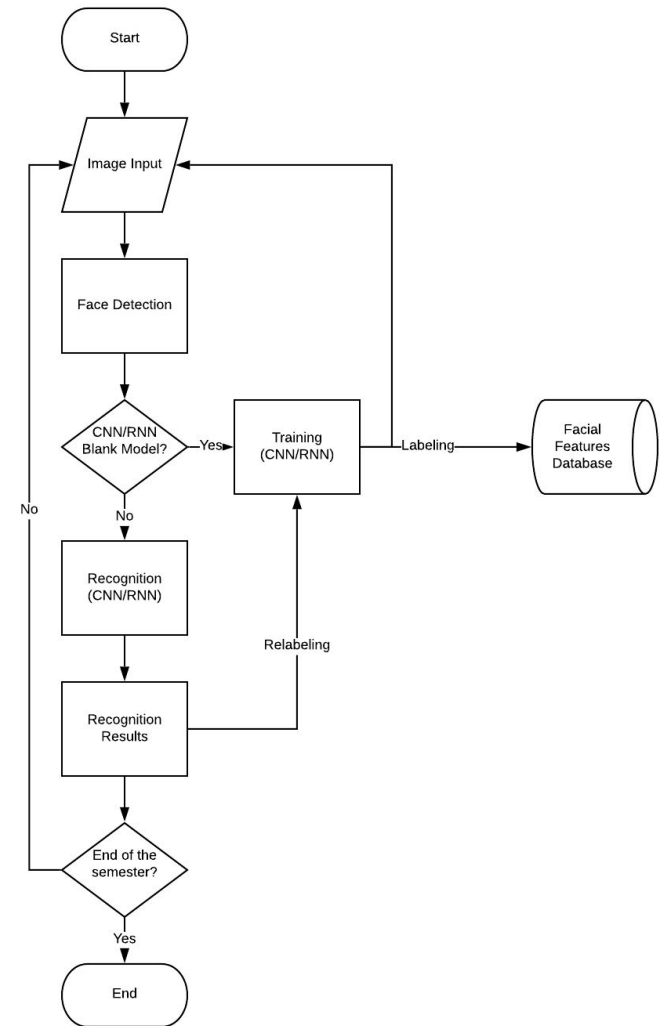
Methodology
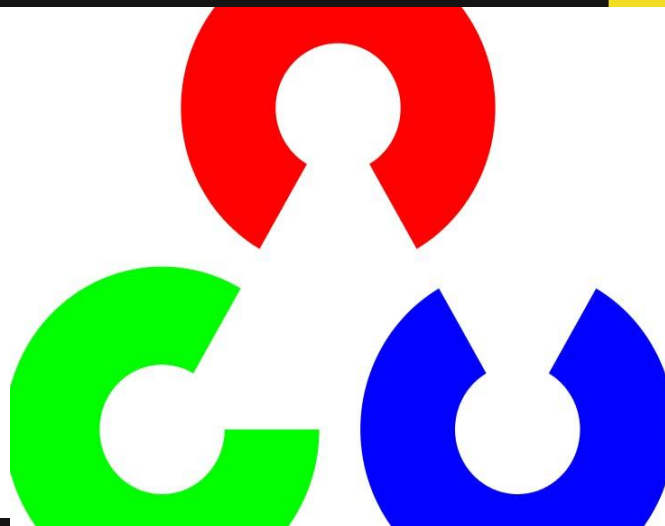
Met

Methodology

Detected Faces

322.png   328.png   333.png   338.png   347.png   386.png

Augmented Faces

158999752
5_0_5044.
png

158999754
1_0_4438.
png

158999756
0_0_4401.
png

158999757
1_0_4142.
png

158999757
7_0_3140.
png

158999758
2_0_2199.
png

Methodology

10 images per day, 6 classes

10 data augmentation methods

600 images per day

| Home | Desktop | Hasper SP | Testing Pictures ▾ |

airah   aya   janine   kat   ludwig   nadine
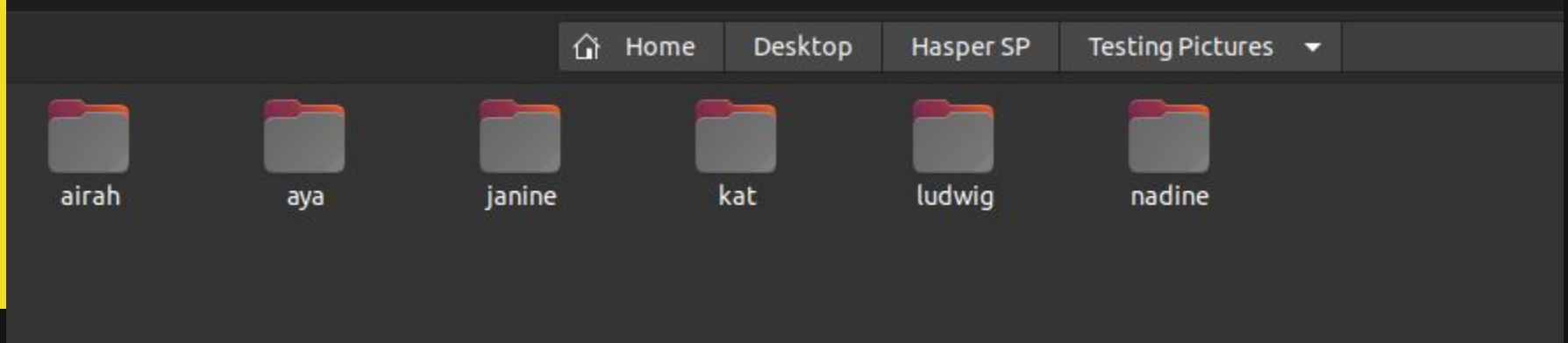
Methodology

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
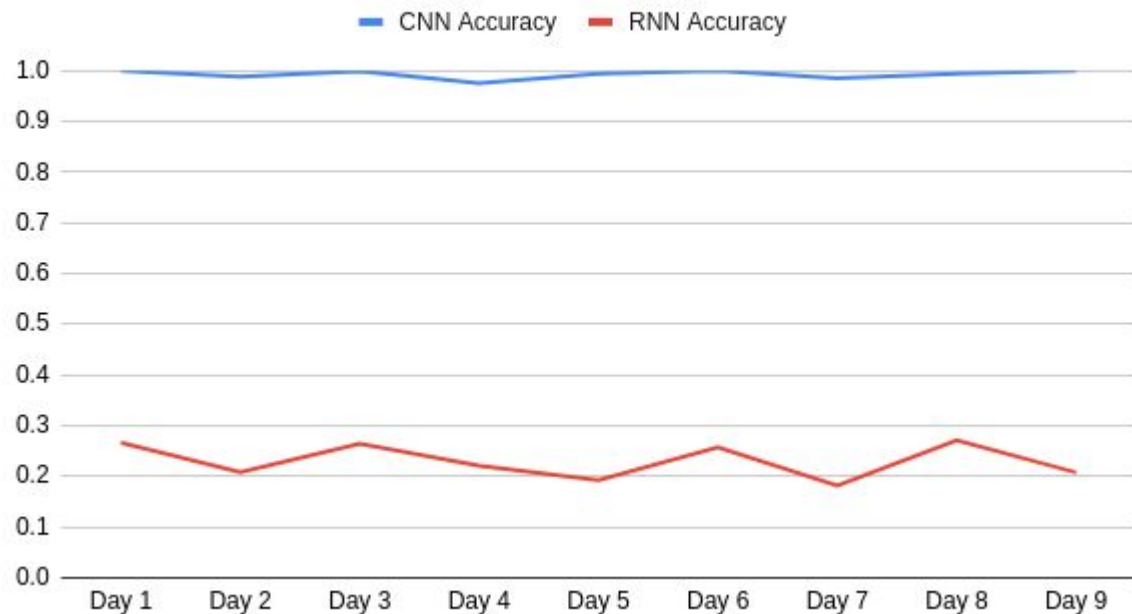
Results

Results

CNN vs RNN Training Val Accuracy
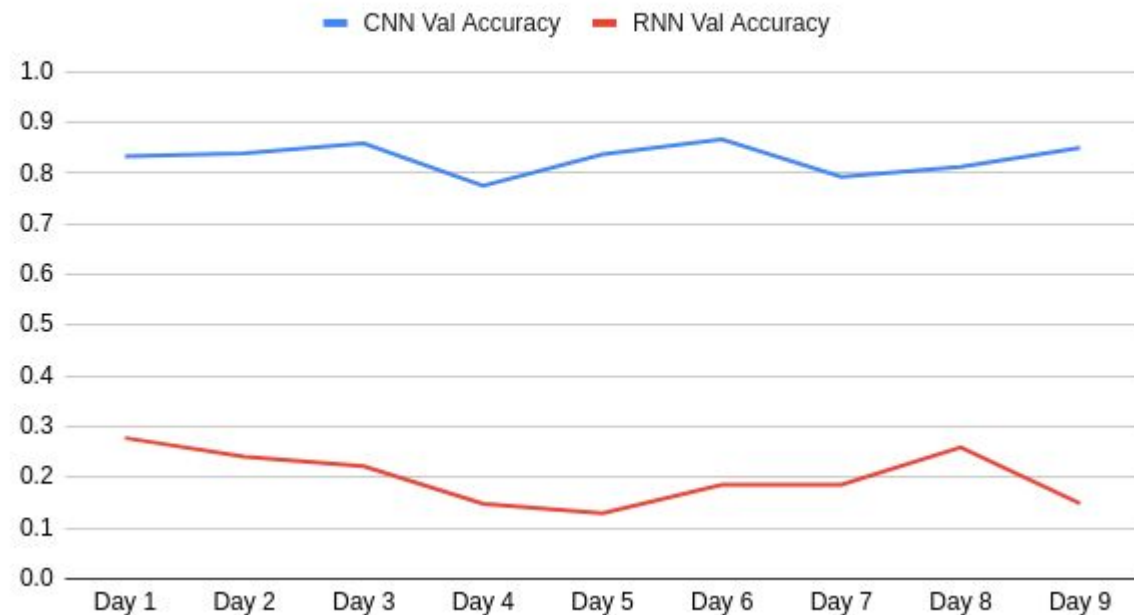
Results

CNN vs RNN Training Val Loss
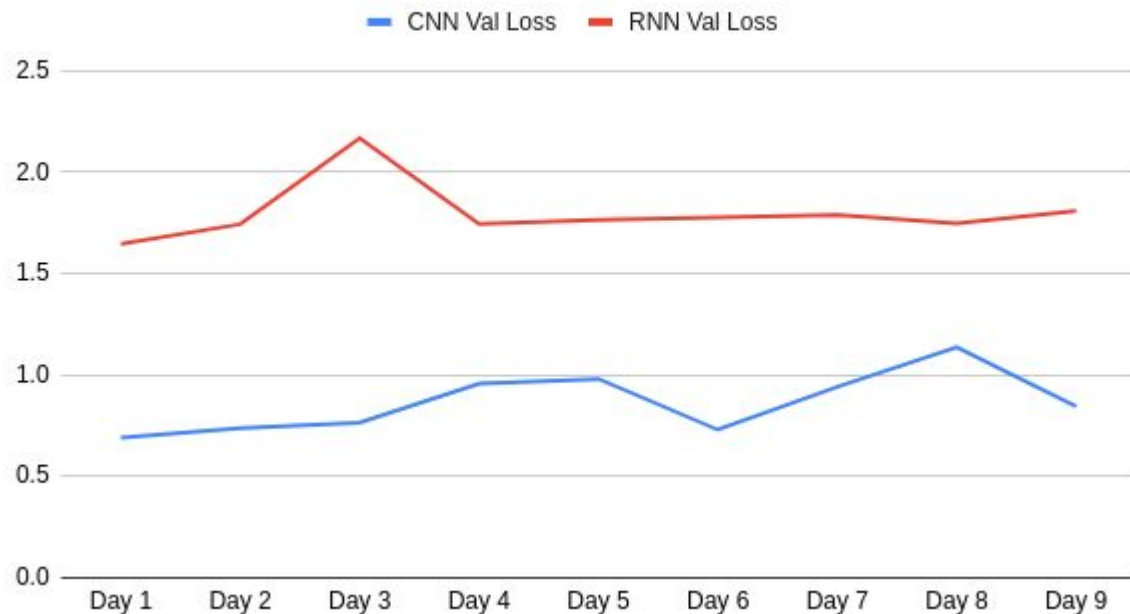
Results

```
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
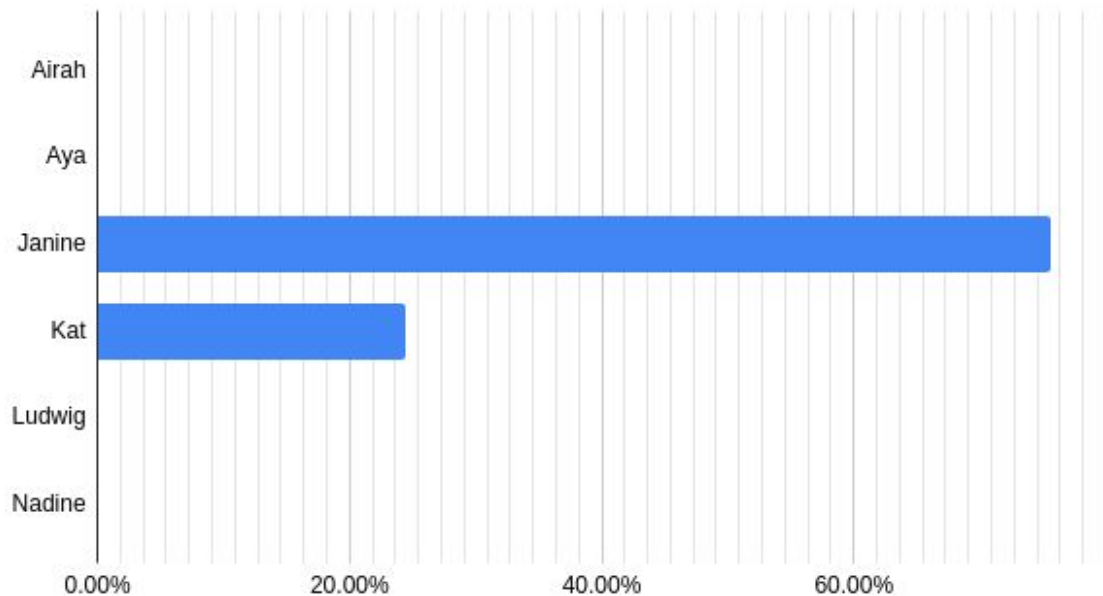
Results
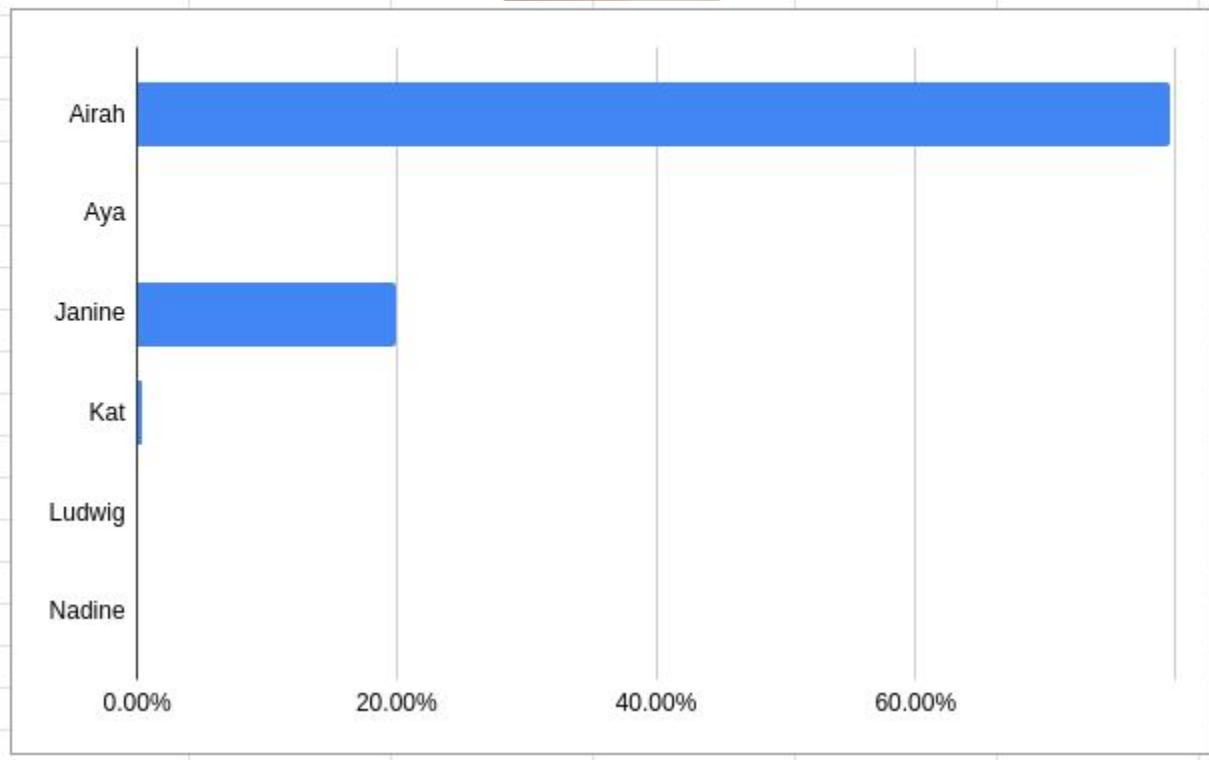
Results
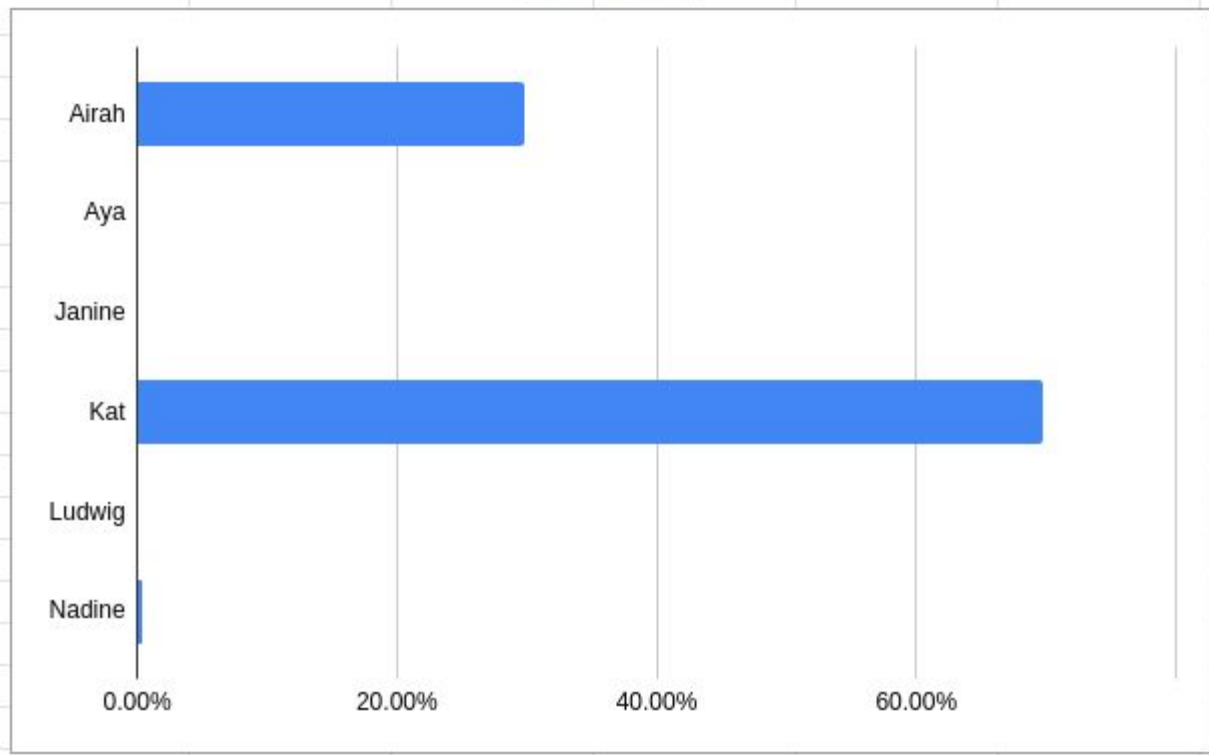
Results

CNN vs RNN Testing Accuracy (Overall)
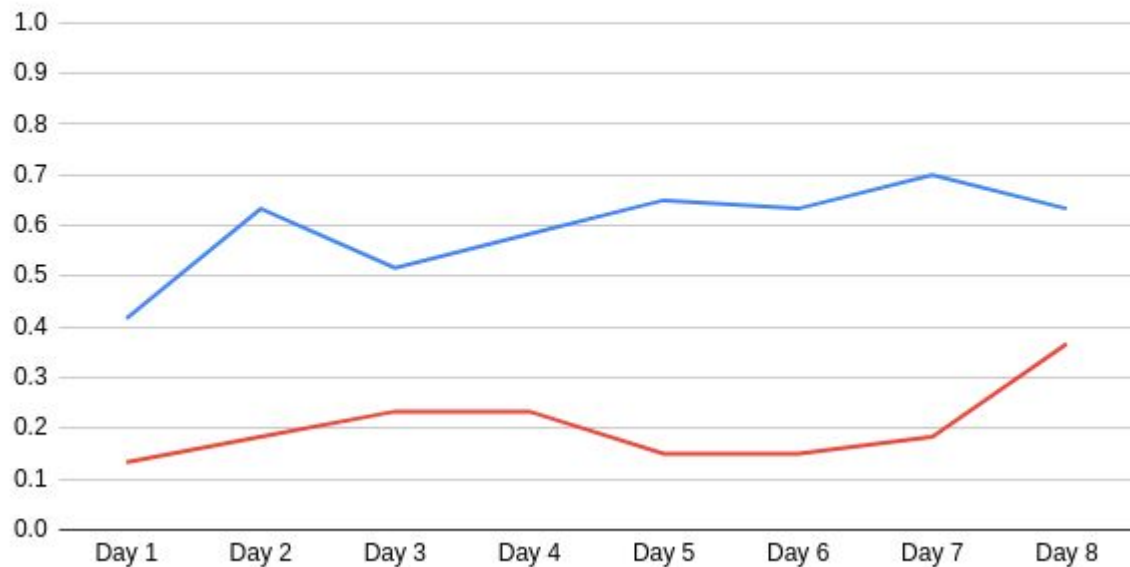
Results

CNN vs RNN Testing Accuracy (Person 1)

CNN Person 1   RNN Person 1

Results

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	

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

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