# **Gesture Recognition**

### **Problem Statement**

Develop a cool feature in the smart-TV that can recognise five different gestures performed by the user which will help users control the TV without using a remote

# **Solution**

Before running any models, generator function was prepared which was loading the data into memory in batches for processing and performing some preprocessing steps like:

- 1. Image Cropping (to 120x120 if the size is 120x160)
- 2. Image Resizing (to 120x120 if the size is 360x360)
- 3. Image Normalization (all color values should be in the range 0 and 1)

Following models were prepared on the final training data:

Exec #	Model	Result	Decision + Explanation			
1	Conv3D	Accuracy: 18.5 Val Accuracy: 17.0	Explanation - Model is not learning	Model: "sequential"		
			Explanation Weden's not learning	Layer (type)	Output Shape	Param #
				conv3d (Conv3D)	(None, 23, 118, 118,	2,624
			Decision - Increase the number of	max_pooling3d (MaxPooling3D)		11. 59. 59. 32)
			parameters	dropout (Dropout)	32) (None, 11, 59, 59, 32) (None, 11, 59, 59, 32) (None, 12, 59, 59, 32) (None, 1225312) (None, 32) (None, 32) (None, 32) (None, 32) (None, 32)	
				flatten (Flatten)		
				dense (Dense)		39,210,016
				dropout_1 (Dropout)	(None, 32)	0
				dense_1 (Dense)	(None, 5)	165
2	Conv3D	Accuracy: 68.8 Val Accuracy: 37.5	Explanation - Model has started	Model: "sequential_1"		
			_ ·	Layer (type)	Output Shape	Param #
			learning but has started overfitting as well	conv3d_1 (Conv3D)	(None, 23, 118, 118, 32)	2,624
			as well	max_pooling3d_1 (MaxPooling3D)	(None, 11, 59, 59, 32)	0
				dropout_2 (Dropout)	(None, 11, 59, 59, 32)	0
			Decision - Increase the number of	flatten_1 (Flatten)	(None, 1225312)	0
			Conv3d layers	dense_2 (Dense)	(None, 32) (None, 32)	39,210,016
			Convociayers	dropout_3 (Dropout)		0
				dense_3 (Dense)	(None, 256)	8,448
				dropout_4 (Dropout)	(None, 256)	0
				dense_4 (Dense)	(None, 5)	1,285
				Total params: 39,222,373 (149.62 Trainable params: 39,222,373 (146 Non-trainable params: 0 (0.00 B)	49.62 MB)	

		1	T			
3	Conv3D	Accuracy: 21.3	Explanation - Model has stopped	Model: "sequential_2"	T	
		Val Accuracy: 27.7	learning, while overcoming	Layer (type) conv3d_2 (Conv3D)	Output Shape (None, 23, 118, 118,	Param #
			overfitting		32)	2,024
				max_pooling3d_2 (MaxPooling3D)	(None, 11, 59, 59, 32)	0
				dropout_5 (Dropout)	(None, 11, 59, 59, 32)	0
			Decision - Add normalization after	conv3d_3 (Conv3D)	(None, 9, 57, 57, 64)	55,360
			every layer	max_pooling3d_3 (MaxPooling3D) dropout_6 (Dropout)	(None, 4, 28, 28, 64) (None, 4, 28, 28, 64)	0
			, ,	flatten_2 (Flatten)	(None, 200704)	0
				dense_5 (Dense)	(None, 32)	6,422,560
				dropout_7 (Dropout)	(None, 32)	0
				dense_6 (Dense)	(None, 256)	8,448
				dropout_8 (Dropout)	(None, 256)	0
				dense_7 (Dense)	(None, 5)	1,285
				Total params: 6,490,277 (24.76 MB Trainable params: 6,490,277 (24.70 Non-trainable params: 0 (0.00 B)		
4	Conv3D	Accuracy: 94.0	Explanation - Model is learning	Model: "sequential_3"		
-	0002	1		Layer (type)	Output Shape	Param #
		Val Accuracy: 63.4	again but with overfitting	conv3d_4 (Conv3D)	(None, 23, 118, 118, 32)	2,624
				max_pooling3d_4 (MaxPooling3D)	(None, 11, 59, 59, 32)	0
			Decision - Increase the number of	batch_normalization	(None, 11, 59, 59, 32)	128
			Conv3d layers	(BatchNormalization)  dropout_9 (Dropout)	(None, 11, 59, 59, 32)	0
				conv3d_5 (Conv3D)	(None, 11, 59, 59, 32)	55,360
				max_pooling3d_5 (MaxPooling3D)	(None, 4, 28, 28, 64)	0
				batch_normalization_1	(None, 4, 28, 28, 64)	256
				(BatchNormalization)	(None 4 20 20 64)	
				dropout_10 (Dropout)  flatten_3 (Flatten)	(None, 4, 28, 28, 64) (None, 200704)	0
				dense_8 (Dense)	(None, 32)	6,422,560
				dropout_11 (Dropout)	(None, 32)	0
				batch_normalization_2	(None, 32)	128
				(BatchNormalization)	(1)	0.440
				dense_9 (Dense) dropout_12 (Dropout)	(None, 256) (None, 256)	8,448
				batch_normalization_3	(None, 256)	1,024
				(BatchNormalization)		
				dense_10 (Dense)	(None, 5)	1,285
				Total params: 6,491,813 (24.76 MB Trainable params: 6,491,045 (24.7 Non-trainable params: 768 (3.00 K	5 MB)	
5	Conv3D	Accuracy: 83.9	Explanation - Model is still	Model: "sequential_5"		
	0002	1		Layer (type)	Output Shape	Param #
		Val Accuracy: 46.4	overfitting	conv3d_12 (Conv3D)	(None, 25, 120, 120, 32)	2,624
				conv3d_13 (Conv3D)	(None, 25, 120, 120, 32)	27,680
			Decision - Change order of Conv3d	max_pooling3d_9 (MaxPooling3D)	(None, 12, 60, 60, 32)	0
			layers along with normalization	batch_normalization_9 (BatchNormalization)	(None, 12, 60, 60, 32)	128
				dropout_18 (Dropout)	(None, 12, 60, 60, 32)	0
				conv3d_14 (Conv3D)	(None, 12, 60, 60, 64)	55,360
				conv3d_15 (Conv3D)	(None, 12, 60, 60, 64)	110,656
				max_pooling3d_10 (MaxPooling3D)	(None, 6, 30, 30, 64)	0
				batch_normalization_10 (BatchNormalization)	(None, 6, 30, 30, 64)	256
				dropout_19 (Dropout)	(None, 6, 30, 30, 64)	0
				conv3d_16 (Conv3D)	(None, 6, 30, 30, 128)	221,312
					(None, 6, 30, 30, 128)	442,496
			batch_normalization_11 (None, 3, 15 (BatchNormalization)	(None, 3, 15, 15, 128)	0	
	1			(BatchNormalization)	(None, 3, 15, 15, 128)	512
						0
				dropout_20 (Dropout)	(None, 3, 15, 15, 128)	
				flatten_5 (Flatten)	(None, 86400)	0
				flatten_5 (Flatten) dense_14 (Dense)	(None, 86400) (None, 32)	2,764,832
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization 12	(None, 86400)	0
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization_12 (BatchNormalization)	(None, 86400) (None, 32) (None, 32) (None, 32)	0 2,764,832 0 128
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization 12	(None, 86400) (None, 32) (None, 32)	0 2,764,832 0
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization_12 (BatchNormalization)  dense_15 (Dense)  dropout_22 (Dropout)  batch_normalization_13	(None, 86400) (None, 32) (None, 32) (None, 32) (None, 256)	0 2,764,832 0 128 8,448
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization_12 (BatchNormalization)  dense_15 (Dense)  dropout_22 (Dropout)  batch_normalization_13 (BatchNormalization)	(None, 86400) (None, 32) (None, 32) (None, 32) (None, 32) (None, 256) (None, 256) (None, 256)	0 2,764,832 0 128 8,448 0 1,024
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization_12 (BatchNormalization)  dense_15 (Dense)  dropout_22 (Dropout)  batch_normalization_13 (BatchNormalization)  dense_16 (Dense)	(None, 86400) (None, 32) (None, 32) (None, 32) (None, 32) (None, 256) (None, 256) (None, 256) (None, 5)	0 2,764,832 0 128 8,448
				flatten_5 (Flatten)  dense_14 (Dense)  dropout_21 (Dropout)  batch_normalization_12 (BatchNormalization)  dense_15 (Dense)  dropout_22 (Dropout)  batch_normalization_13 (BatchNormalization)	(None, 86400) (None, 32) (None, 32) (None, 32) (None, 32) (None, 256) (None, 256) (None, 256) (None, 5)	0 2,764,832 0 128 8,448 0 1,024

6	Conv3D	Accuracy: 72.8	Explanation - Model overfitting has	Model: "sequential_6"		
		· ·	reduced	Layer (type)	Output Shape	Param #
		Val Accuracy: 56.3	reduced	conv3d_18 (Conv3D)	(None, 25, 120, 120, 16)	1,312
				batch_normalization_14 (BatchNormalization)	(None, 25, 120, 120, 16)	64
			Decision - Replace flatten with global average pooling	conv3d_19 (Conv3D)	(None, 25, 120, 120, 16)	6,928
			giobal average pooling	batch_normalization_15 (BatchNormalization)	(None, 25, 120, 120, 16)	64
				max_pooling3d_12 (MaxPooling3D)	(None, 12, 60, 60, 16)	0
				conv3d_20 (Conv3D)	(None, 12, 60, 60, 32)	13,856
				batch_normalization_16 (BatchNormalization)	(None, 12, 60, 60, 32)	128
				conv3d_21 (Conv3D)	(None, 12, 60, 60, 32)	27,680
				batch_normalization_17 (BatchNormalization)	(None, 12, 60, 60, 32)	128
				max_pooling3d_13 (MaxPooling3D)	(None, 6, 30, 30, 32)	0
				conv3d_22 (Conv3D)	(None, 6, 30, 30, 64)	55,360
				batch_normalization_18 (BatchNormalization)	(None, 6, 30, 30, 64)	256
				conv3d_23 (Conv3D)	(None, 6, 30, 30, 64)	110,656
				batch_normalization_19 (BatchNormalization)	(None, 6, 30, 30, 64)	256
				max_pooling3d_14 (MaxPooling3D)	(None, 6, 15, 15, 64)	0
				conv3d_24 (Conv3D)	(None, 4, 13, 13, 128)	221,312
				conv3d_25 (Conv3D)	(None, 2, 11, 11, 128)	442,496
				max_pooling3d_15 (MaxPooling3D)	(None, 2, 5, 5, 128)	0
				flatten_6 (Flatten)  dense_17 (Dense)	(None, 6400) (None, 128)	819,328
				batch_normalization_20	(None, 128)	512
				(BatchNormalization)		
				dropout_23 (Dropout)  dense_18 (Dense)	(None, 128) (None, 512)	66,048
				batch_normalization_21	(None, 512)	2,048
				(BatchNormalization)  dense_19 (Dense)	(None, 5)	2,565
				Total params: 1,770,997 (6.76 MB)	(None, 3)	2,303
				Trainable params: 1,769,269 (6.75 Non-trainable params: 1,728 (6.75		
7	Conv3D	Accuracy: 54.3	Explanation - Model is not learning	Model: "sequential_8"		
7	Conv3D	Accuracy: 54.3	Explanation - Model is not learning	Layer (type)	Output Shape	Param #
7	Conv3D	Accuracy: 54.3 Val Accuracy: 55.4	Explanation - Model is not learning much but overfitting is not there	Layer (type) conv3d_34 (Conv3D)	(None, 25, 120, 120, 16)	1,312
7	Conv3D	· ·	much but overfitting is not there	Layer (type)	(None, 25, 120, 120,	
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)	(None, 25, 120, 120, 16) (None, 25, 120, 120, 16) (None, 25, 120, 120, 16)	1,312 64 6,928
7	Conv3D	· ·	much but overfitting is not there	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)	(None, 25, 120, 120, 16) (None, 25, 120, 120, 16) (None, 25, 120, 120, 120, 120, 120, 120, 120, 120	1,312
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16)	1,312 64 6,928 64
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32)	1,312 64 6,928 64 0 13,856
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16)	1,312 64 6,928 64
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 12, 60, 60, 32)	1,312 64 6,928 64 0 13,856 128 27,680
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 12, 60, 60, 32)	1,312 64 6,928 64 0 13,856
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization_33 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32)	1,312 64 6,928 64 0 13,856 128 27,680 128
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  conv3d_37 (Conv3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 33) (None, 6, 30, 30, 30, 64)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30) (None, 6, 30, 30, 30, 30)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization]  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 32) (None, 6, 30, 30, 32)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30) (None, 6, 30, 30, 30, 30)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  batch_normalization_32 (BatchNormalization)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  max_pooling3d_22 (MaxPooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30, 30) (None, 6, 30, 30, 30, 30) (None, 6, 30, 30, 64) (None, 6, 30, 30, 64) (None, 6, 30, 30, 64)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  max_pooling3d_22 (MaxPooling3D)  conv3d_30 (Conv3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30) (None, 6, 30, 30, 30, 64) (None, 6, 15, 15, 64) (None, 6, 15, 15, 64)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  batch_normalization_32 (BatchNormalization)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  max_pooling3d_22 (MaxPooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30, 30) (None, 6, 30, 30, 30, 30) (None, 6, 30, 30, 64) (None, 6, 30, 30, 64) (None, 6, 30, 30, 64)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  max_pooling3d_22 (MaxPooling3D)  conv3d_40 (Conv3D)  max_pooling3d_23 (MaxPooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 32) (None, 6, 30, 30, 64) (None, 6, 15, 15, 64) (None, 4, 13, 13, 128) (None, 2, 11, 11, 128)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312 442,496
7	Conv3D	·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization]  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  max_pooling3d_22 (MaxPooling3D)  conv3d_40 (Conv3D)  conv3d_40 (Conv3D)  conv3d_41 (Conv3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 32) (None, 6, 30, 30, 64)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312 442,496 0
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  batch_normalization_32 (BatchNormalization)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_36 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_48 (Conv3D)  conv3d_48 (Conv3D)  conv3d_48 (Conv3D)  conv3d_41 (Conv3D)  dobal_average_pooling3d_1 (GlobalAveragePooling3D)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 64)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312 442,496 0 0
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_36 (Conv3D)  batch_normalization_33 (BatchNormalization_33 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_30 (Conv3D)  conv3d_40 (Conv3D)  conv3d_40 (Conv3D)  conv3d_41 (Conv3D)  max_pooling3d_22 (MaxPooling3D)  conv3d_41 (Conv3D)  global_average_pooling3d_1 (GlobalAveragePooling3D)  dense_23 (Dense)  batch_normalization_36	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30, 30) (None, 6, 30, 30, 64) (None, 6, 15, 15, 64) (None, 6, 15, 15, 64) (None, 2, 11, 11, 128) (None, 2, 5, 5, 128) (None, 128)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312 442,496 0 0
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization]  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_48 (Conv3D)  conv3d_48 (Conv3D)  conv3d_40 (Conv3D)  conv3d_41 (Conv3D)  max_pooling3d_22 (MaxPooling3D)  conv3d_41 (Conv3D)  max_pooling3d_23 (MaxPooling3D)  dobat_average_pooling3d_1 (GlobalAveragePooling3D)  dense_23 (Dense)  batch_normalization_36 (BatchNormalization)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 13, 60, 60, 32) (None, 6, 30, 30, 64) (None, 6, 30, 30, 64) (None, 6, 30, 30, 64) (None, 6, 15, 15, 64) (None, 6, 15, 15, 64) (None, 12, 11, 11, 128) (None, 2, 11, 11, 128) (None, 128) (None, 128)	1,312 64 6,928 64 0 13,856 128 27,680 128 255,360 256 110,656 256 0 221,312 442,496 0 0 16,512 512
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  batch_normalization_32 (BatchNormalization)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization_34 (BatchNormalization)  conv3d_38 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_39 (Conv3D)  batch_normalization_35 (BatchNormalization)  conv3d_48 (Conv3D)  conv3d_48 (Conv3D)  conv3d_40 (Conv3D)  conv3d_41 (Conv3D)  dobal_normalization_36 (BatchNormalization_36)  dense_23 (Dense)  batch_normalization_36 (BatchNormalization_36 (BatchNormalization)  dropout_25 (Dropout)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 64) (None, 6, 50, 50, 50, 50) (None, 120) (None, 128) (None, 128)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312 442,496 0 0 16,512 512
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization_31 (BatchNormalization_32 (BatchNormalization_32 (BatchNormalization_32 (BatchNormalization_33 (BatchNormalization_33 (BatchNormalization_33 (BatchNormalization_34 (BatchNormalization_34 (BatchNormalization_34 (BatchNormalization_34 (BatchNormalization_35 (BatchNormalization_36 (BatchNormalization_35 (BatchNormalization_35)  conv3d_30 (Conv3D)  batch_normalization_35 (BatchNormalization_36 (BatchNormalization)  max_pooling3d_22 (MaxPooling3D)  conv3d_40 (Conv3D)  conv3d_41 (Conv3D)  max_pooling3d_23 (MaxPooling3D)  global_average_pooling3d_1 (GtobalAveragePooling3D)  dense_23 (Dense)  batch_normalization_36 (BatchNormalization)  dropout_25 (Dropout)  dense_24 (Dense)  batch_normalization_37	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 64) (None, 6, 15, 15, 64) (None, 7, 11, 11, 128) (None, 128) (None, 128) (None, 128) (None, 128) (None, 128)	1,312 64 6,928 64 0 13,856 128 27,680 128 0 55,360 256 110,656 256 0 221,312 442,496 0 0 16,512 512
7	Conv3D	· ·	much but overfitting is not there  Decision - Use time distributed	Layer (type)  conv3d_34 (Conv3D)  batch_normalization_30 (BatchNormalization)  conv3d_35 (Conv3D)  batch_normalization_31 (BatchNormalization)  max_pooling3d_20 (MaxPooling3D)  conv3d_36 (Conv3D)  batch_normalization_32 (BatchNormalization)  conv3d_37 (Conv3D)  batch_normalization_33 (BatchNormalization)  max_pooling3d_21 (MaxPooling3D)  conv3d_38 (Conv3D)  batch_normalization]  conv3d_38 (Conv3D)  batch_normalization]  conv3d_39 (Conv3D)  batch_normalization]  conv3d_30 (Conv3D)  batch_normalization]  conv3d_40 (Conv3D)  conv3d_40 (Conv3D)  conv3d_40 (Conv3D)  conv3d_41 (Conv3D)  max_pooling3d_22 (MaxPooling3D)  conv3d_41 (Conv3D)  max_pooling3d_23 (MaxPooling3D)  dose_23 (Dense)  batch_normalization_36 (BatchNormalization)  dropout_25 (Dropout)  dense_24 (Dense)  batch_normalization_37 (BatchNormalization)	(None, 25, 120, 120, 16) (None, 12, 60, 60, 16) (None, 12, 60, 60, 32) (None, 6, 30, 30, 30, 64) (None, 6, 15, 15, 64) (None, 6, 15, 15, 64) (None, 2, 11, 11, 128) (None, 128) (None, 128) (None, 128) (None, 128) (None, 128) (None, 512) (None, 5)	1,312 64 6,928 64 0 13,856 128 27,680 128 255,360 256 110,656 256 0 221,312 442,496 0 0 16,512 512 0 66,048 2,048

8	Time	Accuracy: 85.1	Explanation - Model is learning	Model: "sequential"		
	Conv2D +	Val Accuracy: 79.5	without overfitting	Layer (type)	Output Shape	Param #
	GRU	Val Accuracy. 79.3	without over fitting	time_distributed (TimeDistributed)	(None, 25, 120, 120, 32)	896
	GKO		Decision - Try Conv2D with LSTM	batch_normalization (BatchNormalization)	(None, 25, 120, 120, 32)	128
			Decision Try conved with Estivi	time_distributed_1 (TimeDistributed)	(None, 25, 60, 60, 32)	0
				time_distributed_2 (TimeDistributed)	(None, 25, 60, 60, 64)	18,496
				<pre>batch_normalization_1 (BatchNormalization)</pre>	(None, 25, 60, 60, 64)	256
				time_distributed_3 (TimeDistributed)	(None, 25, 30, 30, 64)	0
				time_distributed_4 (TimeDistributed)	(None, 25, 30, 30, 128)	73,856
				batch_normalization_2 (BatchNormalization)	(None, 25, 30, 30, 128)	512
				time_distributed_5 (TimeDistributed)	(None, 25, 15, 15, 128)	0
				time_distributed_6 (TimeDistributed)	(None, 25, 128)	0
				time_distributed_7 (TimeDistributed)	(None, 25, 128)	16,512
				batch_normalization_3 (BatchNormalization)	(None, 25, 128)	512
				dropout (Dropout)	(None, 25, 128)	0
				gru (GRU)	(None, 128)	99,072
				<pre>batch_normalization_4 (BatchNormalization)</pre>	(None, 128)	512
				dense_1 (Dense)	(None, 5)	645
9	Time	Accuracy: 61.8		Model: "sequential_1"		
	C=2D	· · · · · · · · · · · · · · · · · · ·	Explanation - Model is not able to	Layer (type)	Output Shape	Param #
	Conv2D +	Val Accuracy: 55.4	learn enough, but there is no sign	Layer (type)  time_distributed_8 (TimeDistributed)	Output Shape (None, 25, 120, 120, 32)	<b>Param #</b>
	Conv2D + ConvLSTM	· · · · · · · · · · · · · · · · · · ·		time_distributed_8		
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting	time_distributed_8 (TimeDistributed) batch_normalization_5	(None, 25, 120, 120, 32)	896
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better	time_distributed_8 (TimeDistributed)  batch_normalization_5 (BatchNormalization)  time_distributed_9	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32)	128
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed_10	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32)	896 128 0
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed_10 (TimeDistributed_0) batch_normalization_6	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64)	896 128 0 18,496
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed)  batch_normalization_5 (BatchNormalization)  time_distributed_9 (TimeDistributed)  time_distributed_10 (TimeDistributed)  batch_normalization_6 (BatchNormalization)  time_distributed_11	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64)	896 128 0 18,496
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed) time_distributed_12	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64)	896 128 0 18,496 256
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatcNormalization) time_distributed_9 (TimeDistributed) time_distributed_10 (TimeDistributed) batch_normalization_6 (BatcNNormalization_6 (BatcNNormalization) time_distributed_11 (TimeDistributed) time_distributed_12 (TimeDistributed_12 (TimeDistributed_1) batch_normalization_7	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 64)	896 128 0 18,496 256 0 73,856
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed_9 (TimeDistributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed_12 (TimeDistributed_22 (TimeDistributed_32 (TimeDistributed_33 time_distributed_33 time_distributed_31 time_distributed_31 time_distributed_33	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 128)	896  128  0  18,496  256  0  73,856  512
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed_9 (TimeDistributed) time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed_12 (TimeDistributed_0) batch_normalization_7 (BatchNormalization_7 (BatchNormalization_1) time_distributed_13 (TimeDistributed_13 (TimeDistributed_13 (TimeDistributed_13	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 64) (None, 25, 30, 30, 30, 128) (None, 25, 30, 30, 30, 128)	896  128  0  18,496  256  0  73,856  512
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed] time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed_12 (TimeDistributed) time_distributed_12 (TimeDistributed) batch_normalization_7 (BatchNormalization) time_distributed_13 (TimeDistributed_13 (TimeDistri	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 128) (None, 25, 30, 30, 128) (None, 25, 15, 15, 128) (None, 13, 13, 16)	896  128  0  18,496  256  0  73,856  512  0  83,008
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed] time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed_12 (TimeDistributed_22 (TimeDistributed_32 (TimeDistributed_32 (TimeDistributed_33 (TimeDistr	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 63) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 128) (None, 13, 13, 16) (None, 13, 13, 16)	896  128  0  18,496  256  0  73,856  512  0  83,008
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed) time_distributed_12 (TimeDistributed) batch_normalization_7 (BatchNormalization_7 (BatchNormalization) time_distributed_13 (TimeDistributed) conv_lstmd (ConvLSTM2D) batch_normalization_8 (BatchNormalization_8 (BatchNormalization_9) dlobal_average_pooling2d_1 (Globalaveragepooling2d_1 (Globalaveragepooling2d_1	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 120) (None, 25, 30, 30, 30, 120) (None, 25, 15, 15, 120) (None, 13, 13, 16) (None, 13, 13, 16) (None, 13, 13, 16) (None, 128) (None, 128)	896  128  0  18,496  256  0  73,856  512  0  83,008  64
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed] time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed_12 (TimeDistributed_22 (TimeDistributed_32 (TimeDistributed_32 (TimeDistributed_33 (TimeDistr	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 63) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 128) (None, 25, 15, 15, 128) (None, 13, 13, 16) (None, 13, 13, 16) (None, 13, 13, 16) (None, 128) (None, 128) (None, 128)	896  128  0  18,496  256  0  73,856  512  0  83,008  64  0  2,176
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed) batch_normalization_5 (BatchNormalization) time_distributed_9 (TimeDistributed) time_distributed_10 (TimeDistributed) batch_normalization_6 (BatchNormalization) time_distributed_11 (TimeDistributed) time_distributed_12 (TimeDistributed) batch_normalization_7 (BatchNormalization) time_distributed_13 (TimeDistributed) conv_lstmuted_13 (TimeDistributed_13 (TimeDistribut	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 63) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 128) (None, 25, 15, 15, 128) (None, 13, 13, 16) (None, 13, 13, 16) (None, 13, 13, 16) (None, 128) (None, 128) (None, 128) (None, 128)	896 128 0 18,496 256 0 73,856 512 0 83,008 64 0 2,176 512 0 66,048
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed_9) batch_normalization_5 (BatcNormalization_5) time_distributed_9 (TimeDistributed_9) time_distributed_10 (TimeDistributed_10 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_12 (TimeDistributed_12 (TimeDistributed_12 (TimeDistributed_13 (Tim	(None, 25, 120, 120, 32) (None, 25, 120, 120, 32) (None, 25, 60, 60, 632) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 120) (None, 25, 30, 30, 120) (None, 25, 15, 15, 120) (None, 13, 13, 16) (None, 13, 13, 16) (None, 13, 13, 16) (None, 128) (None, 128) (None, 128) (None, 128) (None, 128) (None, 512)	896  128  0  18,496  256  0  73,856  512  0  83,008  64  0  2,176  512  0  66,048  2,048
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed_9) batch_normalization_5 (BatcNormalization_1) time_distributed_9 (TimeDistributed_9) time_distributed_10 (TimeDistributed_10 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_12 (TimeDistributed_12 (TimeDistributed_12 (TimeDistributed_13 (Tim	(None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 63) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 128) (None, 25, 15, 15, 128) (None, 13, 13, 16) (None, 13, 13, 16) (None, 128) (None, 512) (None, 512)	896  128  0  18,496  256  0  73,856  512  0  83,008  64  0  2,176  512  0  66,048  2,048
	1	· · · · · · · · · · · · · · · · · · ·	learn enough, but there is no sign of overfitting  Decision - GRU is giving better accuracy and is an equivalently	time_distributed_8 (TimeDistributed_9) batch_normalization_5 (BatcNormalization_5) time_distributed_9 (TimeDistributed_9) time_distributed_10 (TimeDistributed_10 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_11 (TimeDistributed_12 (TimeDistributed_12 (TimeDistributed_12 (TimeDistributed_13 (Tim	(None, 25, 120, 120, 32) (None, 25, 60, 60, 32) (None, 25, 60, 60, 63) (None, 25, 60, 60, 64) (None, 25, 60, 60, 64) (None, 25, 30, 30, 64) (None, 25, 30, 30, 30, 128) (None, 25, 15, 15, 128) (None, 13, 13, 16) (None, 13, 13, 16) (None, 128) (None, 128) (None, 128) (None, 128) (None, 128) (None, 128) (None, 512) (None, 512) (None, 512)	896  128  0  18,496  256  0  73,856  512  0  83,008  64  0  2,176  512  0  66,048  2,048

## **Selected Model**

Model Selected - Time Distributed Conv2D + GRU Accuracy = 80.51 Validation Accuracy = 81.25

#### Hyperparameters:

- batch\_size = 16
- learning\_rate = 0.01
- epochs = 50