

# Human/Animal Emotion Recognition Using ECG & ML Techniques



EndEvaluation  
Group 22

# Project Team

## Team

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## Supervisors

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- Dr. Isuru Nawinne
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# Problem

## Why Emotion Recognition



- Way to communicate beyond words
- Provide emotional intelligence to computing systems.
- Entertainment, marketing, healthcare, e- learning etc...

## Emotion Recognition Methods



- Physiological Signals (ECG, EEG)
- Behavioral Expressions (Facial, Speech)
- Computational Methods
- Self Report



## Why ECG?

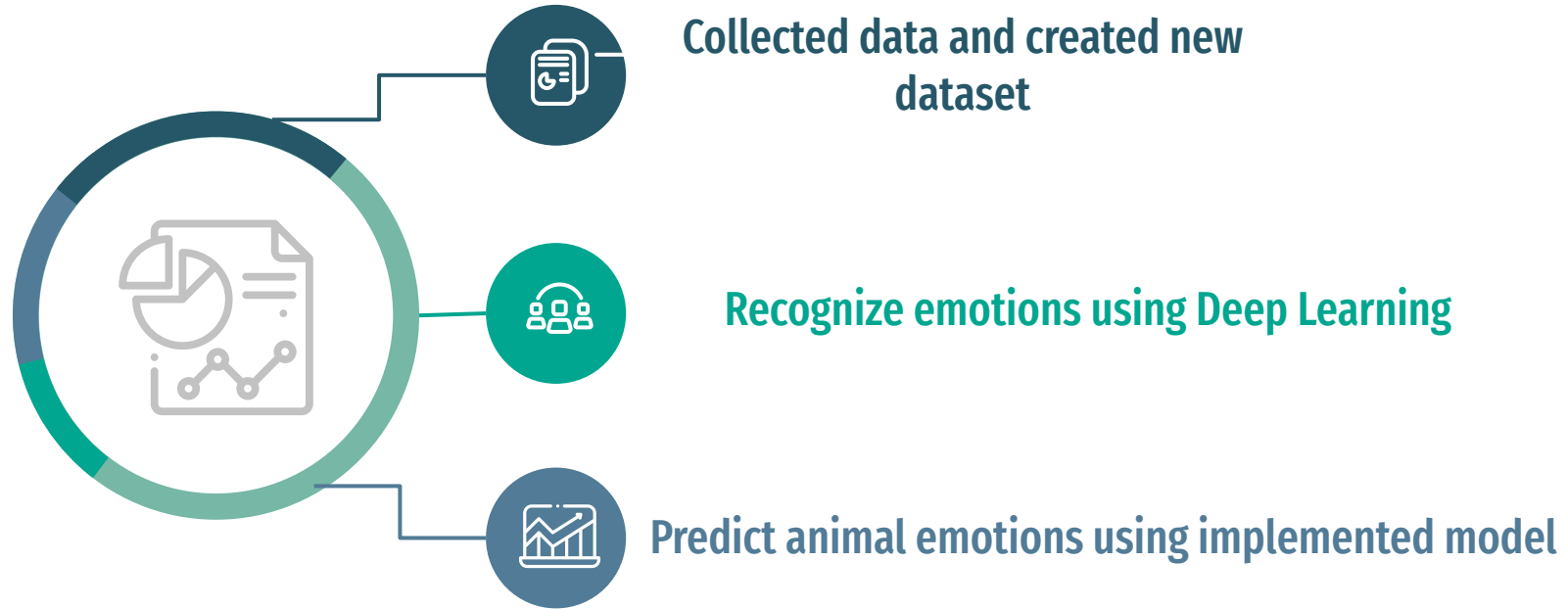
- Comfortable wearable device
- Capture from different parts of the body
- High amplitude bio-sensors
- Prospective technique



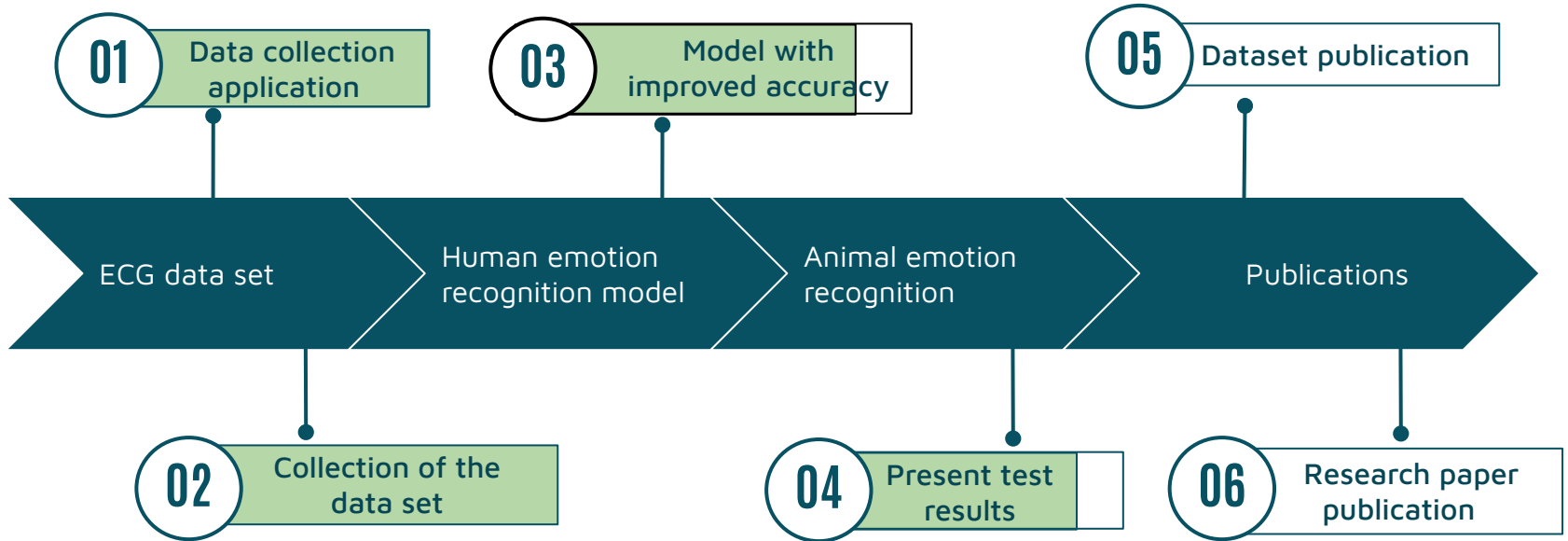
## Animal Emotion Prediction

- Difficult to define animal emotion
- Communication is easier
- Animal protection

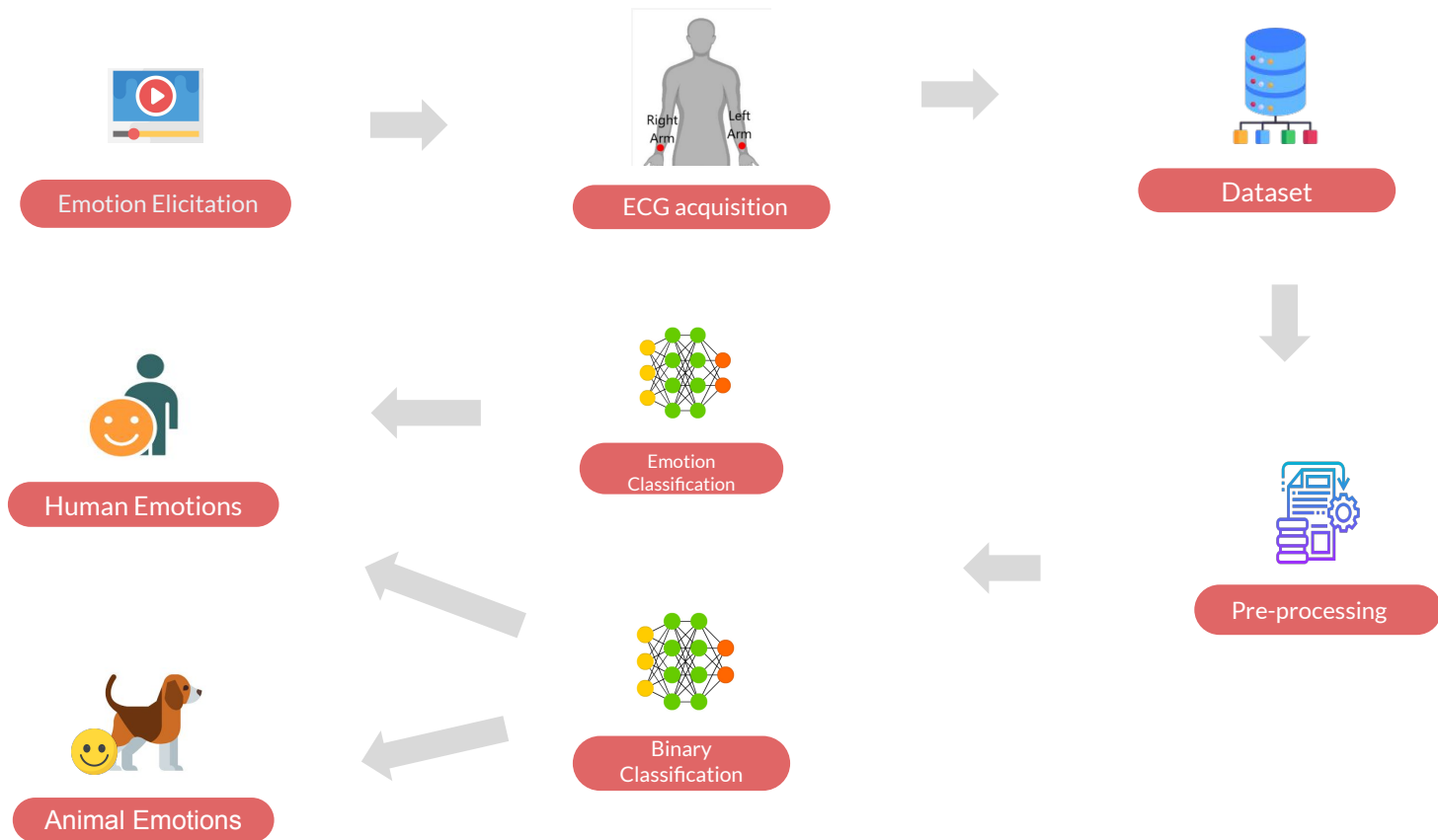
# Solution



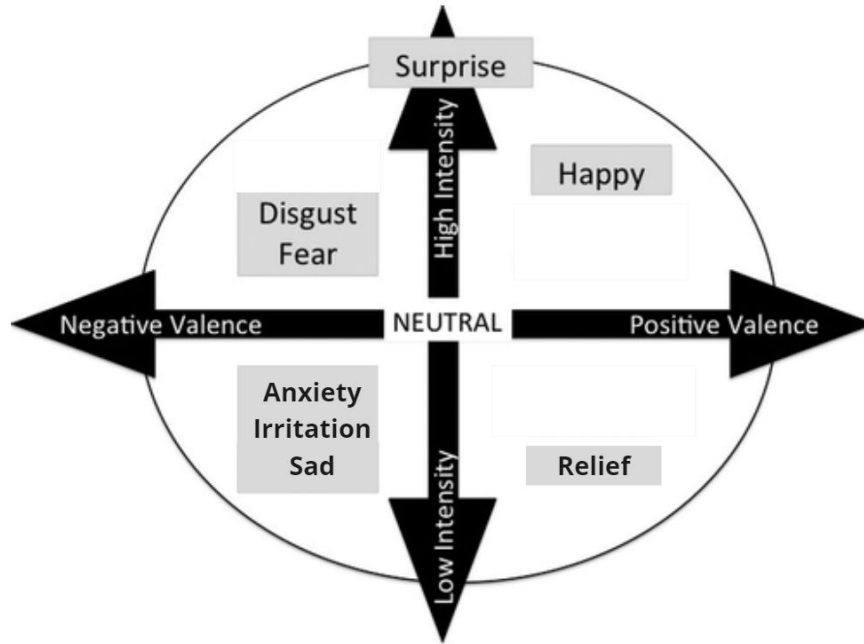
# Progress



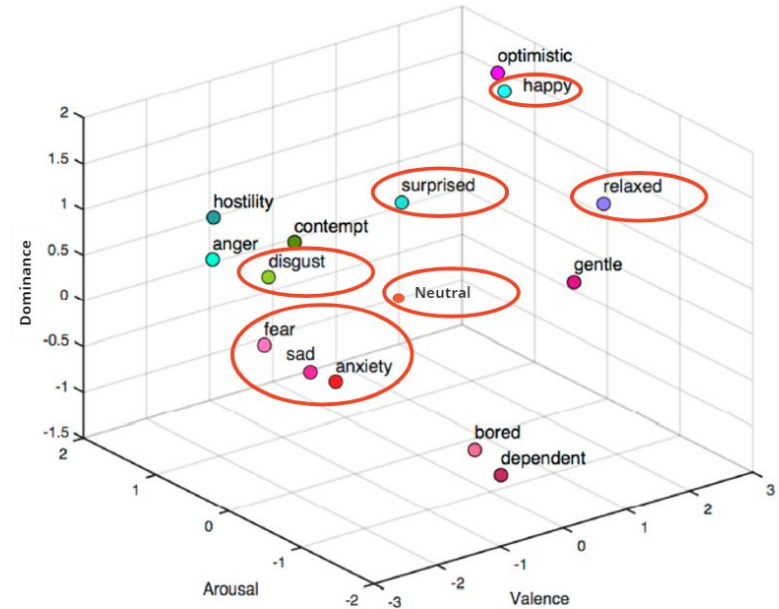
# Methodology



# Emotion Selection



Two-dimensional emotional model



Three-dimensional emotional model

# Data Acquisition

Automated Data Collection

ECG Lead Placement

25 Subjects

Data Collector REGISTER

Select Climaxes

Entered Climaxes

Emotion	Start	End
Relief	0.30	1.00

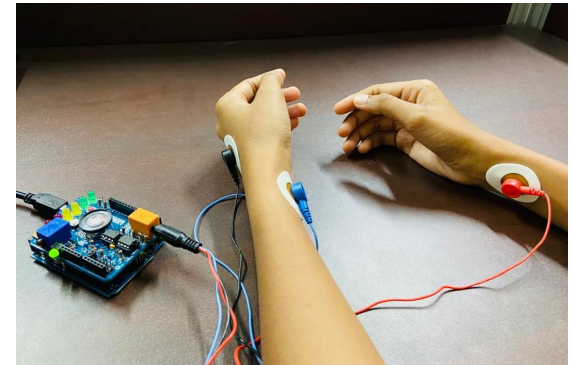
SUBMIT ALL RECORDS

0:00 / 1:16

Did you felt Relief ☒

Start of the climax \* 0.30 End of the climax \* 1.00

ADD

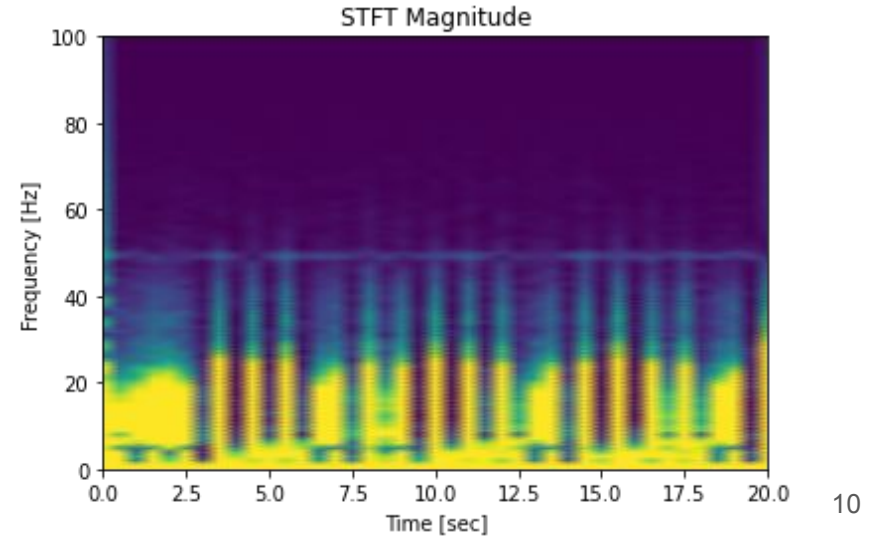
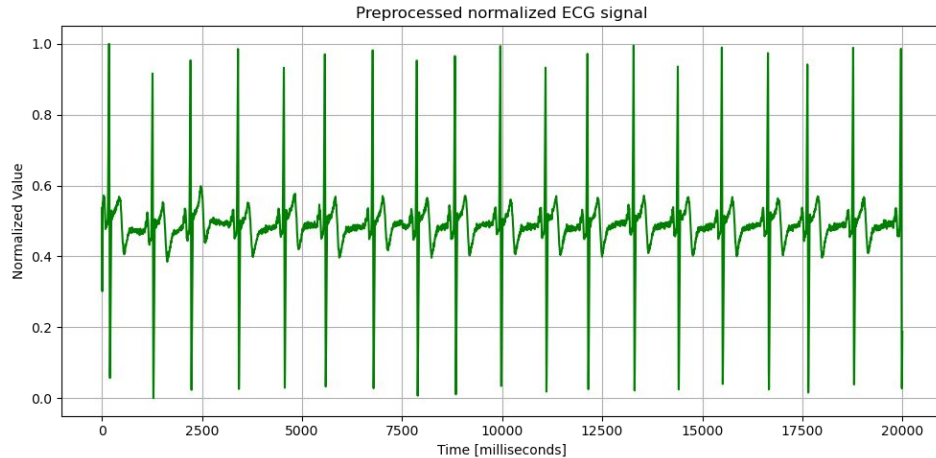
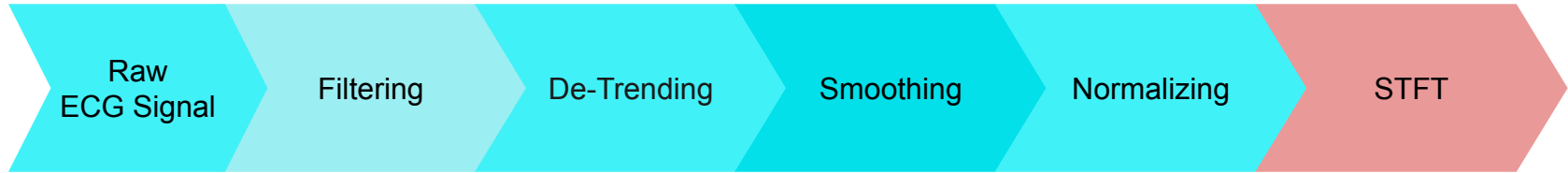




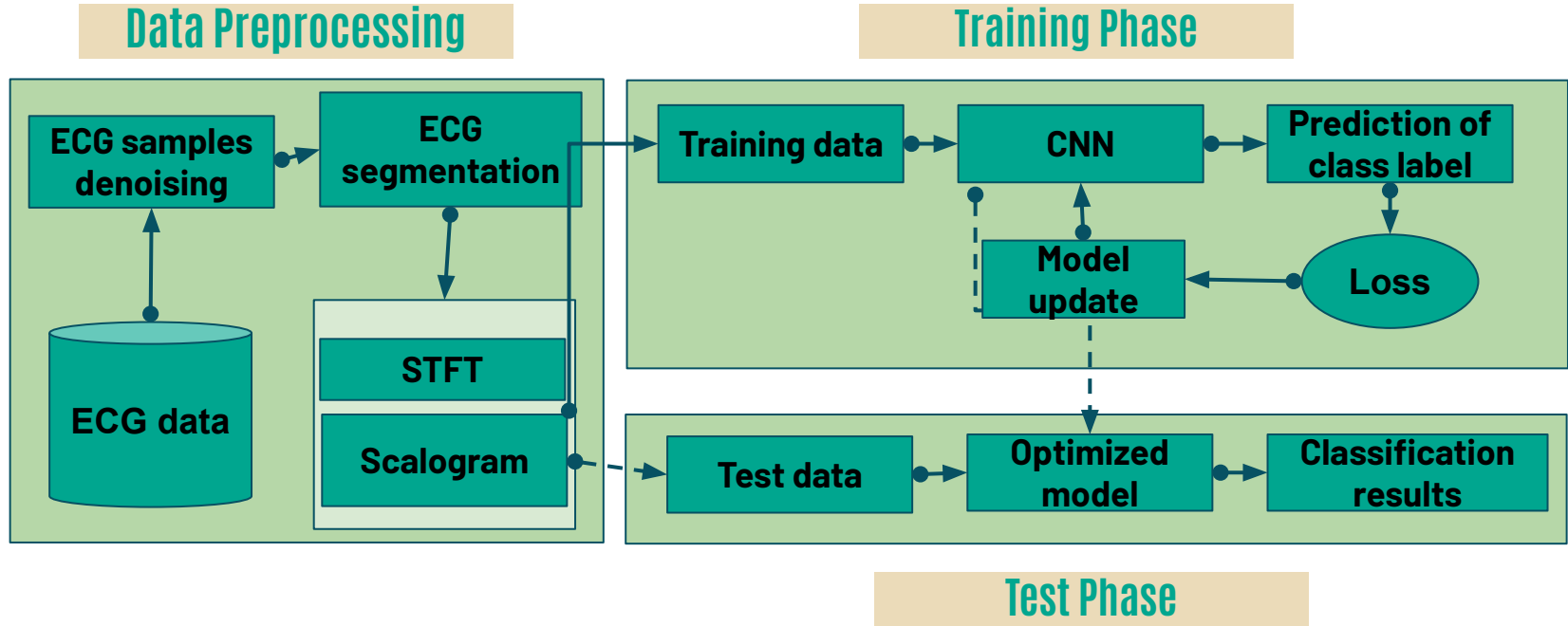
# Data Summary

Emotion	Film / Video	Duration	Hits	Misses	Discarded & Not taken
Neutral	A Black Screen	1 min	17	0	8
Happy	Lottery Ticket (2010)	1:29 mins	18	3	4
Relief	Blood Diamond (Journalist)	1:16 mins	13	8	4
Sad	My Sister's keeper(doctor)	1:51 mins	18	2	5
Irritation	The Pursuit of Happiness	1:42 mins	13	7	5
Anxiety	Limitless (apartment)	1:34 mins	13	8	4
Disgust	Slumdog Millionaire (blinded)	1:28 mins	15	3	7
Fear	The Conjuring (2013)	03:19 mins	17	0	8
Surprise	One Day	0:55 mins	21	0	4

# Data Pre-processing



# Emotion classification



# Model Development

Nine emotion Model



40%

Positive - Negative Model  
(Valence)

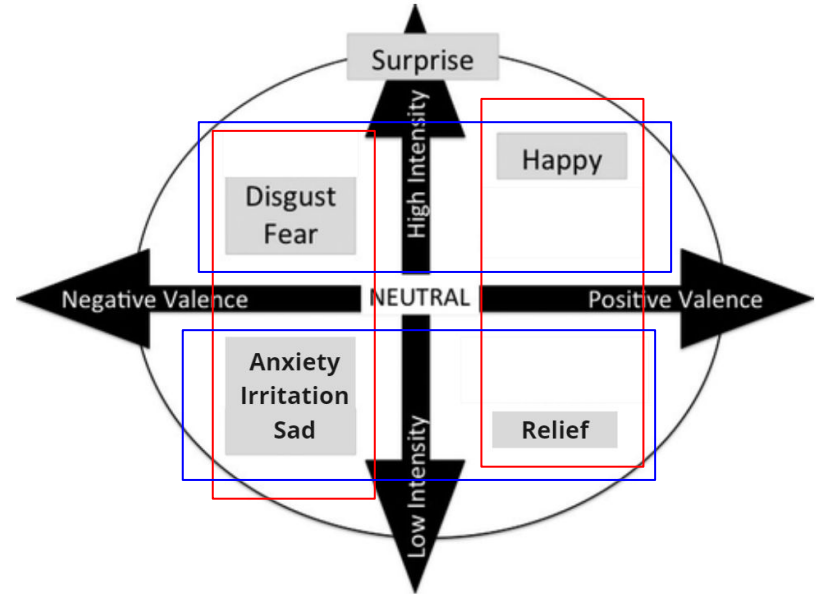


70%

Active-Passive Model  
(Arousal)



65%



# Model Summary

Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
conv2d (Conv2D)	(None, 254, 254, 16)	448
max_pooling2d (MaxPooling2D)	(None, 127, 127, 16)	0
conv2d_1 (Conv2D)	(None, 125, 125, 32)	4640
max_pooling2d_1 (MaxPooling2D)	(None, 62, 62, 32)	0
conv2d_2 (Conv2D)	(None, 60, 60, 16)	4624
max_pooling2d_2 (MaxPooling2D)	(None, 30, 30, 16)	0
flatten (Flatten)	(None, 14400)	0
dense (Dense)	(None, 256)	3686656
dense_1 (Dense)	(None, 9)	2313

=====  
Total params: 3,698,681  
Trainable params: 3,698,681  
Non-trainable params: 0  
=====

Nine emotion model  
summary

Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
conv2d (Conv2D)	(None, 254, 254, 16)	448
max_pooling2d (MaxPooling2D)	(None, 127, 127, 16)	0
conv2d_1 (Conv2D)	(None, 125, 125, 32)	4640
max_pooling2d_1 (MaxPooling2D)	(None, 62, 62, 32)	0
conv2d_2 (Conv2D)	(None, 60, 60, 16)	4624
max_pooling2d_2 (MaxPooling2D)	(None, 30, 30, 16)	0
flatten (Flatten)	(None, 14400)	0
dense (Dense)	(None, 256)	3686656
dense_1 (Dense)	(None, 1)	257

=====  
Total params: 3,696,625  
Trainable params: 3,696,625  
Non-trainable params: 0  
=====

Positive - Negative  
Model (Valence)

Model: "sequential"

Layer (type)	Output Shape	Param #
=====		
conv2d (Conv2D)	(None, 254, 254, 16)	448
max_pooling2d (MaxPooling2D)	(None, 127, 127, 16)	0
conv2d_1 (Conv2D)	(None, 125, 125, 32)	4640
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=====  
Total params: 3,696,625  
Trainable params: 3,696,625  
Non-trainable params: 0  
=====

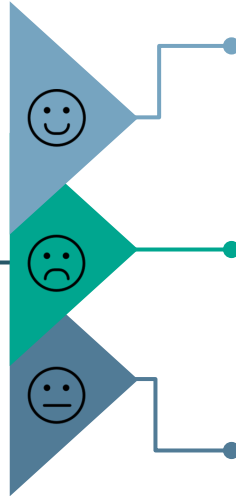
Active-Passive Model  
(Arousal)

# Animal Emotion Data Collection

10 Subjects

Emotion States

Clinical  
Environment



## Positive

Called by their name and  
petted by owners

## Negative

Commanded by owners and  
when they show unwillingness

## Neutral

After they calm down and get  
used to the environment

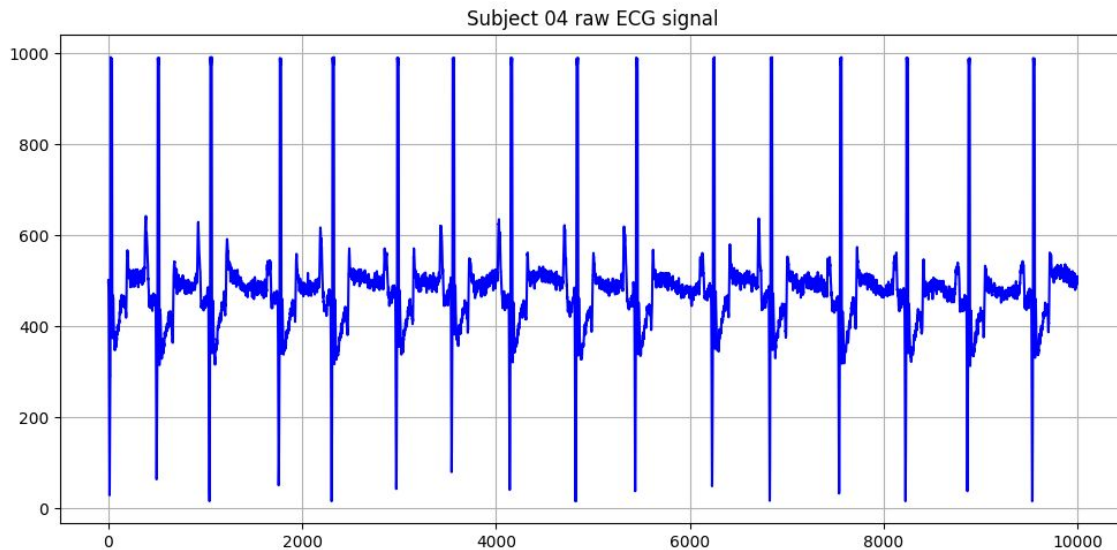


# ECGs of Dogs

Same Experimental Setup

Similar ECG

Test Results With Valance  
Model - 32%



# Q & A



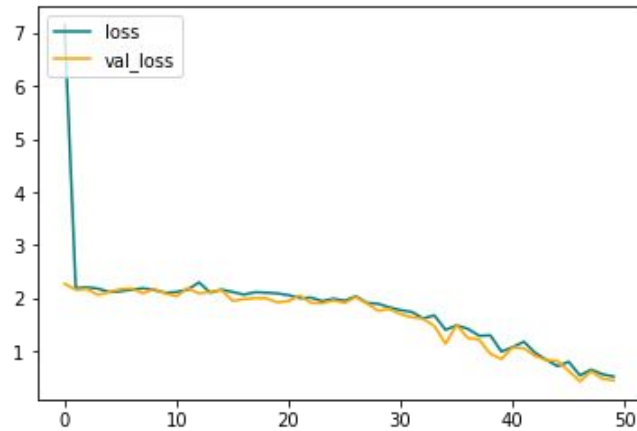
**Thank You!**

# Positive - Negative Model

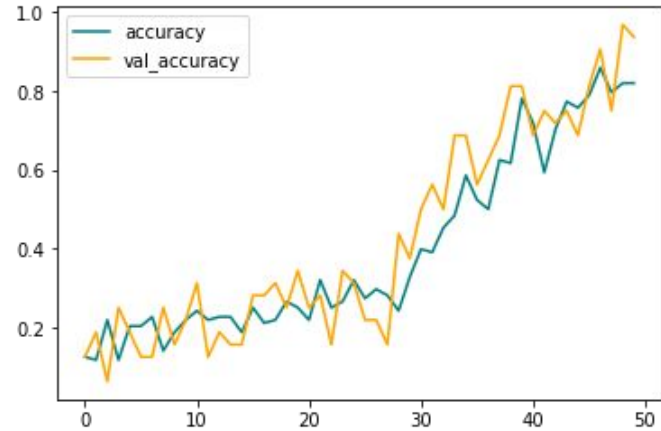


# Nine Emotion Model

Loss

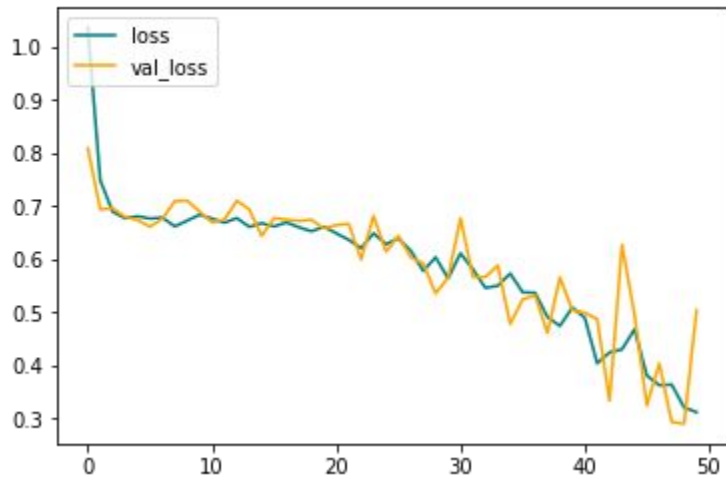


Accuracy

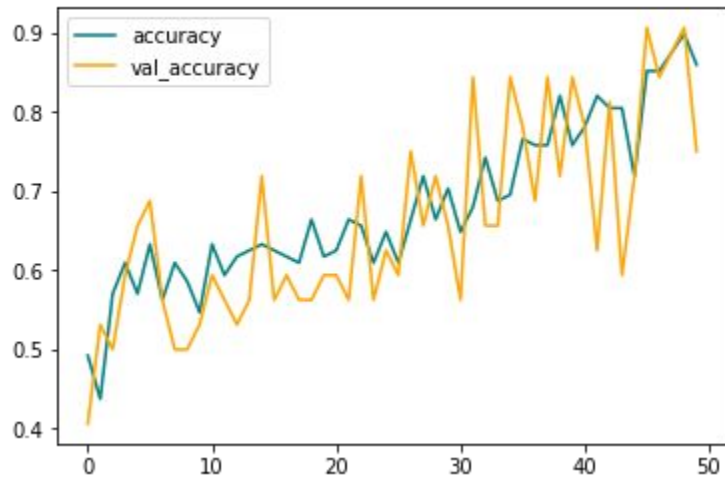


# Active - Passive Model

Loss



Accuracy



# Summary