



Human/Animal Emotion Recognition Using ECG & ML Techniques

Group 22

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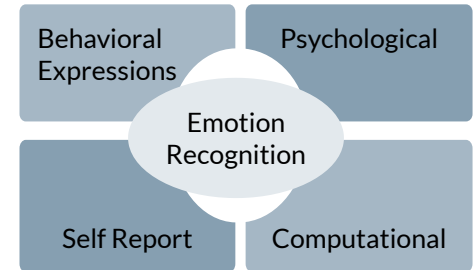
Introduction

Emotion

- Way to communicate beyond words
- Complex processes that involve feelings, body movement, etc

Emotion Recognition

- In order to understand behavior and make decisions
- Affective computing
 - Entertainment,marketing, healthcare,e- learning etc..., .
 - Interaction with computers more productive and interactive.
 - Provide emotional intelligence to computing systems.



Emotion recognition methods

Literature Review

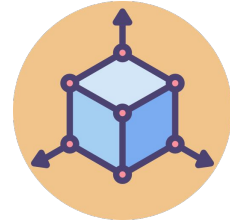
Theoretical Background



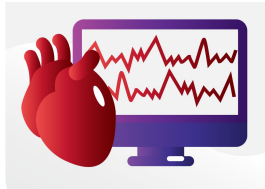
Human Emotions



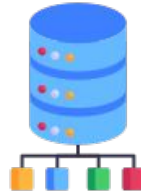
Animal Emotions



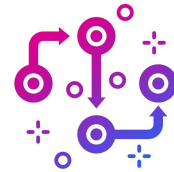
Emotional Modeling



Electrocardiography



ECG Data Sets



Methodology

Human Emotions

Study	Adopted Emotions	Emotion Elicited Method	No.of Subjects	Accuracy
Rattanyu and Mizukawa (2011)	anger, fear, sadness, joy, disgust, neutral	Picture	12	61.44%
Jeritta et al. (2012)	neutral, happiness, sadness, fear, surprise, disgust	Video	15	59.78%
Murugappan et al. (2013)	disgust, sadness, fear, joy, neutral	Video	20	66.48%
Jerritta et al. (2014)	neutral, happiness, sadness, fear, surprise, disgust	Video	30	54%
Guo et al. (2016)	sadness, angry, fear, happy, relaxed	Video	25	56.9%
Dissanayake et al (2019)	anger, sadness, joy, pleasure	Video	25	80.00%

An Ensemble Learning Approach for Electrocardiogram Sensor Based Human Emotion Recognition
Authors: Dissanayake et al (2019)
Task: Results overview comparison

Animal Emotions



- Difficult to define and quantify animal emotions
 - Less reliable dataset



- Benefits of examining animal emotions
 - Predicting the pain level intensity, animal protection, Communication is easier



- Comparison between human and animal emotions
 - Human -mixed emotions
 - Animals- simple and basic

Animal Emotion Detection and Application

Authors: Singh et al (2021)

Task : Benefits of animal emotion detection

Measuring Farm Animal Emotions -Sensor-Based Approach

Authors: Suresh Neethirajan et al (2021)

Task : How to identify animal emotions

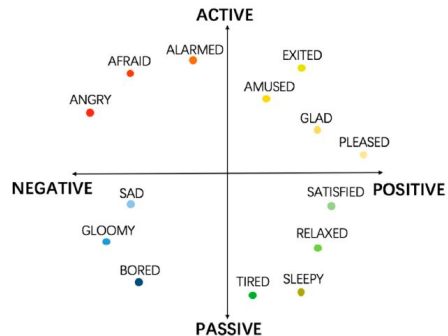
Emotional Modeling

Six basic emotions

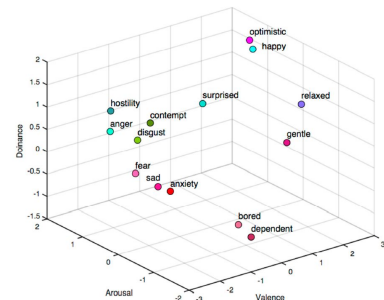
- Happiness
- Sadness
- Anger
- Fear
- Surprise
- disgust



Plutchik's Wheel of emotions



Two-dimensional space emotional model



Three-dimensional space emotional model

Discrete Emotion Models

Affective Dimensional Models

Feel my heart: Emotion recognition using the electrocardiogram.

Authors: Magalhães et al (2021)

Task : Emotion Models

A Review of Emotion Recognition using Physiological signals

Authors: Shu L et al (2018)

Task : Emotion Models

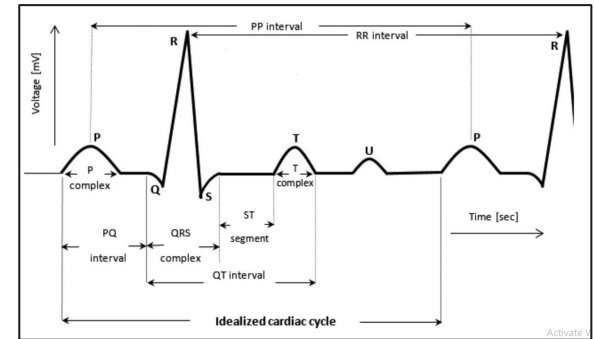
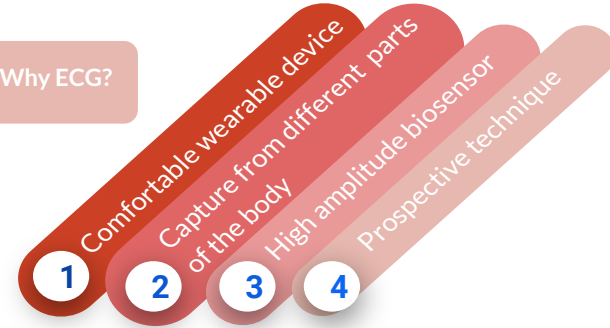
Electrocardiography

- Analyze the heart's conduction system (electrical activity)
- Electrocardiogram (ECG)
 - assess the electrical activity of the heart.
 - Analyze psychological properties for emotion recognition
- Electrode placement - Arms, Legs, Chest
- Composed of three distinct waves:
 - P wave,
 - QRS complex
 - T wave.

An Ensemble Learning Approach for Electrocardiogram Sensor Based Human Emotion Recognition
Authors: Dissanayake T et al (2019)
Task: Why ECG is using to recognize emotions

Electrocardiogram-Based Emotion Recognition Systems and Their Applications in Healthcare—A Review
Authors: Hansul et al (2021)
Task : Detail about electrocardiography

Why ECG?



ECG Datasets

Database	No.of Subjects	No.of Electrodes	Electrode Placement	Stimuli	Location
AMIGOS	40	3	Arms, Left Ankle	40 participants watched 16 short videos, 37 participants watched 4 long videos	Lab
ASCERTAIN	58	3	Arms, Left Foot	58 volunteers watched 36 movie clips between 51-127s	Lab
DECAF	30	3	Wrists, Arm (boney part)	40 1-minute music records 36 movie clips	Lab
DREAMER	23	3	Lead I and Lead II vector	18 affective videos 65 - 393s long	Isolated environment
MAHNOB-HCI	27	3	Chest	Image Tagging, 20 films 35-117s long	Lab
WESAD	15	3	Chest & Wrist	funny video clip, 5 min speech, guided meditation	Lab
SWELL	25	3	Chest	write reports and make presentations on predefined topics	Lab

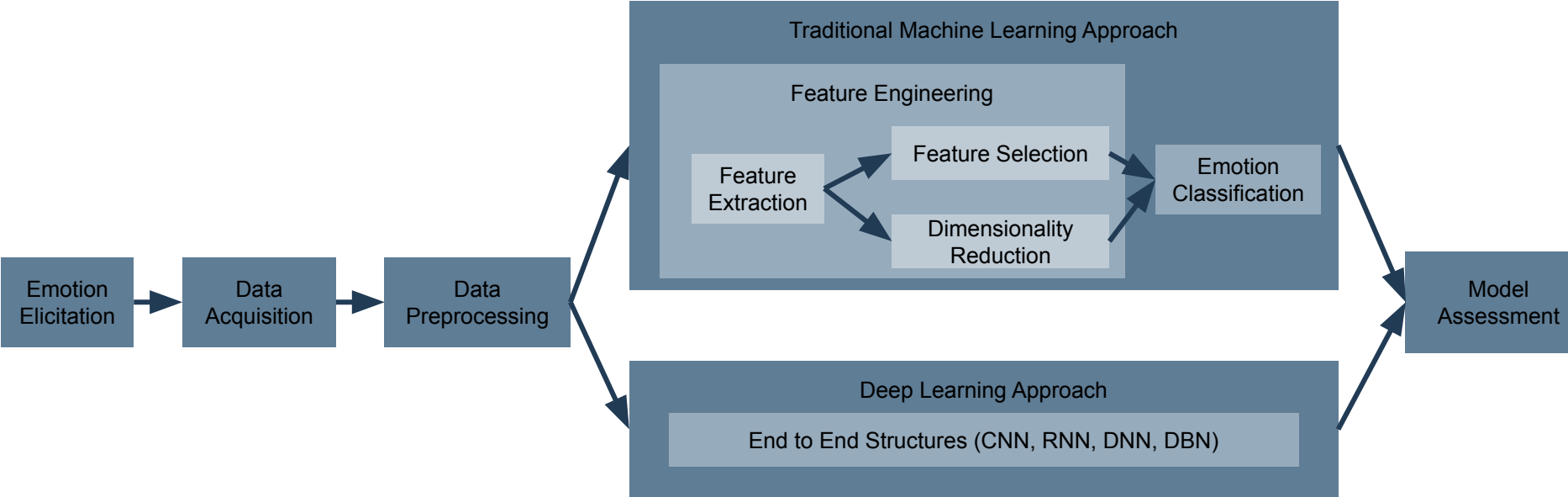
Feel my heart: Emotion recognition using the electrocardiogram.
 Authors: Magalhães et al (2021)
 Task : Emotion Models

A Review, Current Challenges, and Future Possibilities on Emotion Recognition Using Machine Learning and Physiological Signals
 Authors: P. J. Bota et al (2019)
 Task : Detail about different datasets

Electrocardiogram-Based Emotion Recognition Systems and Their Applications in Healthcare—A Review
 Authors: Hansul et al (2021)
 Task : Detail about different datasets

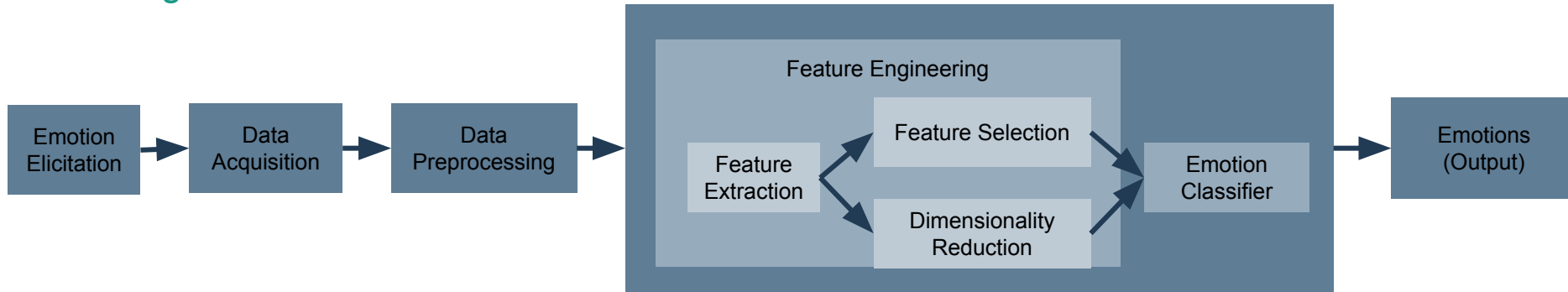
Methodology

Model Training Procedure



Methodology cont...

Testing Procedure



Emotion Recognition using ECG Signals with Local Pattern Description Methods.
Authors: Tivatansakul et al (2015)
Task : Testing procedure

Electrocardiogram-Based Emotion Recognition Systems and Their Applications in Healthcare—A Review
Authors: Hansul et al (2021)
Task : Methods for Machine Learning System

Feel my heart: Emotion recognition using the electrocardiogram
Authors: Magalhães et al (2021)
Task : Emotion Recognition process

Emotion Elicitation



Audio Visuals

All basic emotions



Imagery

Happiness, Surprise, Fear, Anger



Music

Happiness, Sadness, Fear



Memory Recall

Happiness, Sadness, Disgust, Anger, Fear



Situational Procedures

Happiness, Anger, Fear, Surprise

Electrocardiogram-Based Emotion Recognition Systems and Their Applications in Healthcare—A Review

Authors: Hasnul MA et al (2021)

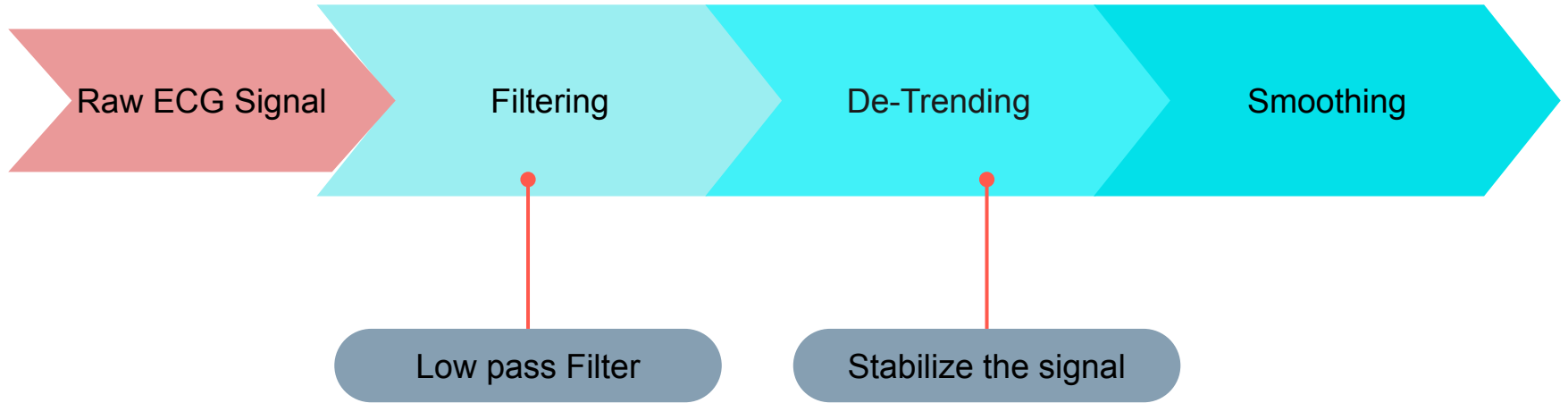
Task: Emotion elicitation techniques

A Review, Current Challenges, and Future Possibilities on Emotion Recognition Using Machine Learning and Physiological Signals

Authors: P. J. Bota et al (2019)

Task: Emotion elicitation techniques

Signal Pre-processing

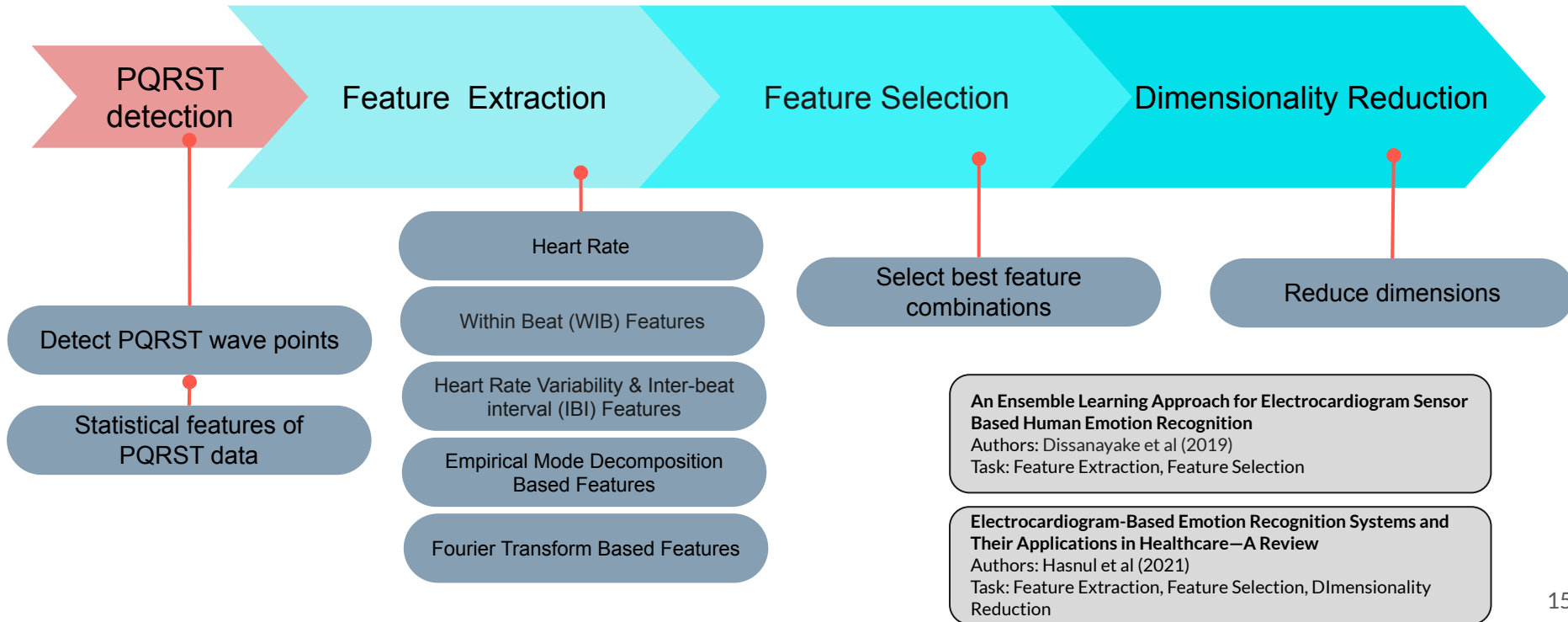


Butterworth filter is mostly used

Electrocardiogram-Based Emotion Recognition Systems and Their Applications in Healthcare—A Review
Authors: Hasnul MA et al (2021)
Task: ECG signal pre-processing

An Ensemble Learning Approach for Electrocardiogram Sensor Based Human Emotion Recognition
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Task: ECG signal pre-processing

Feature Engineering



Classification Models

SVM

Most popular classifier

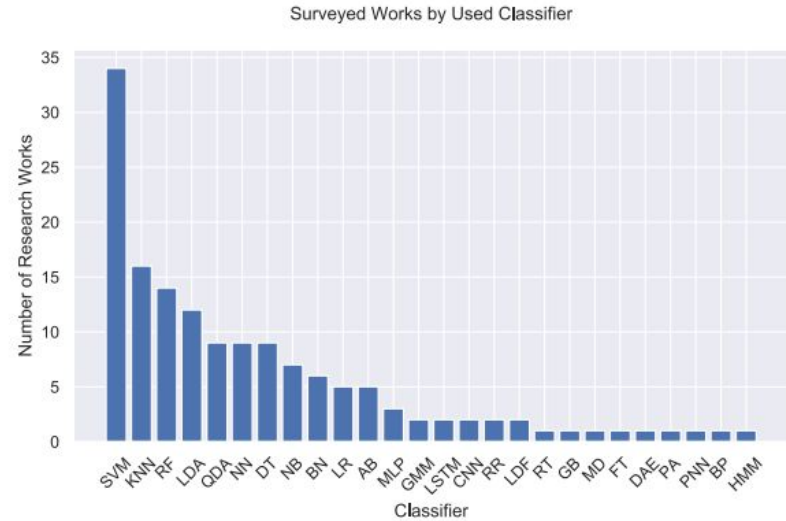
K-NN, Naive Bayes(NB), ...

Well performing classifiers

A Review, Current Challenges, and Future Possibilities on Emotion Recognition Using Machine Learning and Physiological Signals

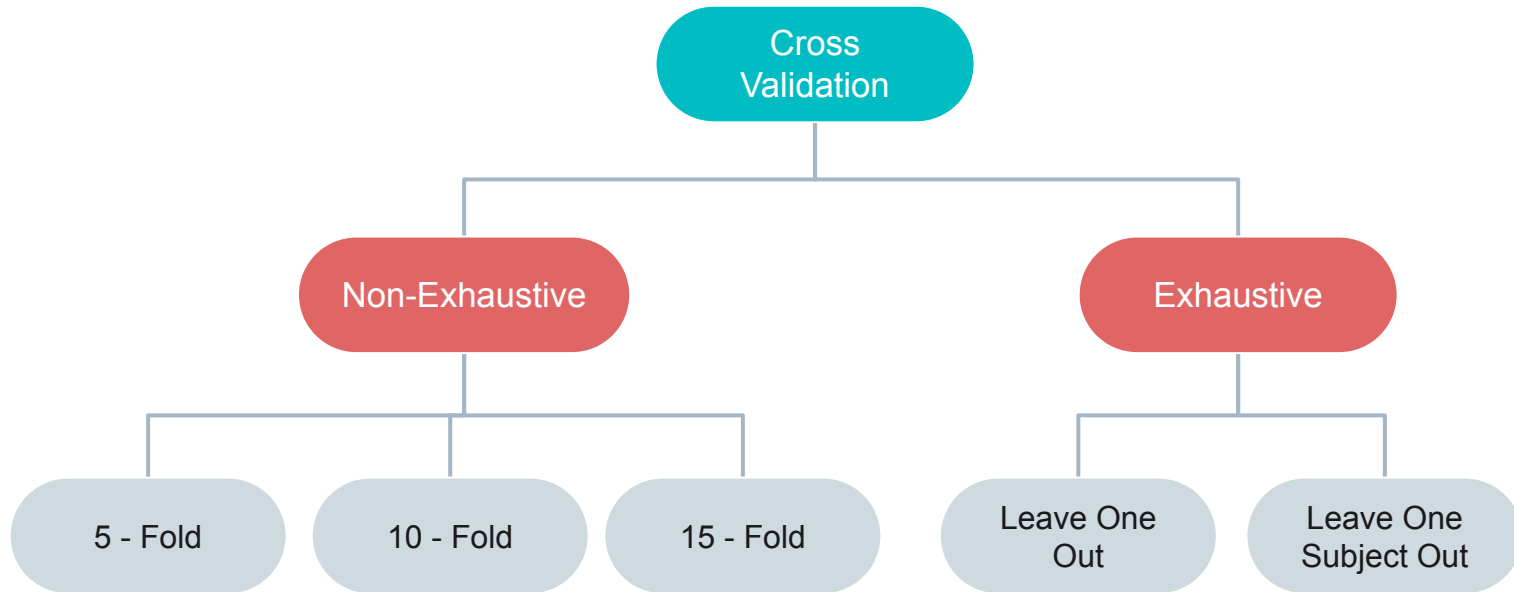
Authors: P. J. Bota et al (2019)

Task : Details about classification models



Histogram of the number of publications per classifier

Validation



Electrocardiogram-Based Emotion Recognition Systems and Their Applications in Healthcare—A Review

Authors: Hansul et al (2021)

Task : Model validation methods

Research Gaps

01

Data sets

Lack of affective databases with a large number of samples

Expanded ECG Data set

02

Accuracy

Less number of Emotions have predicted

Improved Emotion Recognition Model

03

Animal Emotions

Difficult to study animal emotions

Animal Emotion Detection Using Improved Model

Q & A



Thank You

