**Aggression**

Aggression is expressing hostility or violent behavior often without provocation. It could be physical or verbal intended to cause harm to someone.

Aggression could simply be frustration when something is not in your favor or could be a mental condition. While anger is a feeling, aggression is a behavior. Anger is just a feeling and it is normal for a person to experience anger as it might also give relief. But aggression is a choice. Abusing substances, such as alcohol, tends to increase rates of aggression. It can also be caused from genetic inheritance, other biological origins, and mental health problems.

Aggressive behavior causes antisocial personality disorder, depression, self-harm and extreme impulsivity.

Different types of aggression are physical violence, instrumental violence, verbal hostility, non-verbal intimidation, passive aggression.

**Dementia**

Dementia is a term for a decline in mental ability. Dementia has a wide range of symptoms such as memory loss, decline in ability to focus and lose control over visual perception. People with dementia have problems with memory, keeping track of belongings and planning. Many dementias are progressive. Symptoms start out slowly and then get worse.

The brain has many regions. Each of which is responsible for different functions like memory, judgment and movement. When cells in a region are damaged, that region will not be able to carry out its functions normally. Some of the types are Alzheimer’s, Parkinson’s disease and vascular dementia.

Dementia is treated based on the cause of it. There are drug treatments that may improve only symptoms. Regular physical exercise may lower risk of some types of dementia. Work is still being done to find a cure for dementia.

**Alzheimer’s disease**

Alzheimer’s is a type of dementia that disrupts memory, thinking and behavior. As it is a progressive disease, the symptoms usually develop slowly and get worse over time. This interferes with everyday activities.

It is the most common form of dementia and is not related with age contrary to popular belief as majority of Alzheimer’s patients are over 65. The risk factor increases as a person grows older and doubles every 5 years after 65.

A number of factors such as age, genetics, environment and lifestyle determines if a person will develop Alzheimer’s.

**Genetics and Alzheimer’s:**

There are two categories of genes that influence whether a person develops a disease- risk genes and deterministic genes

Risk genes increase the likelihood of developing the disease but do not guarantee it.

Deterministic genes guarantee that anyone who inherits it develops the disorder.

Symptoms include memory loss, difficulty in completing familiar tasks, confusion with time, trouble understanding and spatial relationships and trouble with words in speaking or writing.

A cure for Alzheimer’s has not been found yet. But treatment may help with symptoms. There is extensive research work going on along with clinical trials to find a cure.

**Patient on Patient aggression**

Generally people with dementia or Alzheimer’s have the same needs as everyone else which includes comfort, social interaction, emotional wellbeing and being free from pain. However, these patients might be unable to recognize their needs or how to communicate them with others. This may cause them to act in ways that others might find challenging, including aggression. This aggressive behavior might be the patient’s way of meeting the need or communicating it.

When patients are kept in the same room, there is a possibility that they might behave aggressively to each other from time to time. This behavior can result in verbal abuse or even physical violence if the patient is able enough.

Since these patients are often victims of worsening of mood and other symptoms, it is really difficult to keep track of them and intervene before they act out.

**Patient on caregiver aggression**

Caregivers are also a victim of aggressiveness by patients as they spend most of their time with the patients. There are a number of things that can be triggers of violence such as pain, reduced hearing, noise, locked rooms, no privacy and relationship with caregivers. Although physical and chemical restraints are used to manage them, there is concern about its safety. These restraints can do more harm than good.

Caregivers often adopt strategies to avoid conflict. These include distraction, ignoring and positive nurturing.

**How to detect aggression**

Aggression can be detected by

1. Monitoring heart rate
2. Tracking facial expressions
3. Tracking sudden movements
4. Monitoring blood pressure

**Aggression detection systems that already exist**

1. SoundIntel - Sigard audio analytics is based on sophisticated sound detection and analysis. Whenever a sensor in the Sigard aggression detection system registers the characteristics of human aggression, the system sends out an alert. It will trigger the camera closest to the incident or other security devices. The system works indoor and outdoor. [a]- Cited
2. Cassandra- This system aims to detect human aggression in a complex real-world environment. It combines video and audio, together with contextual cues. It works on visual input and audio input.

# Cassandra is also a research paper -Multi-modal human aggression detection. [0]

1. Louroe electronics- This system is capable of recognizing aggression in a person’s voice. The system automatically and objectively detects human aggression and warns staff so that physical aggression can be prevented.

**Research on aggression detection**

Spontaneous facial expression recognition: Automatic aggression detection [1]

This paper was based on isolating aggression from facial expressions. Based on tracking specific points of a face, selected from a video sequence, a trajectory of the face’s movement was made. Then, using the Gabor filter and Local Binary Patterns (LBP) operator, extraction and analysis of the facial features was performed. Classifiers were used to classify spontaneous facial data to detect aggression.

Automatic aggression detection inside trains [2]

This paper addressed challenges of video analysis for automatic detection of aggression in a train.  Using data from surveillance cameras, the system assists human operators in their work. Existing algorithms were used to recognize and classify human behavior. The observation model included camera alignment, motion segmentation and tracking.

**Trying to solve the aggression problem**

1. We can use heart rate/ pulse rate monitors as an initial filtering process as we know that during the aggression process the pulse rate increases.
2. Cameras can be used to capture facial expressions of the patients and analyze it using software to check for aggression.
3. Voice analysis and speech analysis can be performed by recording voice through a microphone.

Perspiration sensors could be used but is not recommended because perspiration could be a symptom or a side effect of being hospitalized.

We can also check if the area around the face turns red because anger in some patients triggers increased blood flow around the periorbital region as well as around the ears which is visible.

**Things needed**

Wearable’s can be used to detect pulse rate.

Camera and microphone to record video and audio.

Once we get inputs from pulse rate monitor, facial feature extraction, voice and speech analysis, we can implement machine learning to refine our output by providing inputs positive and negative with aggression to make the algorithm learn to classify the inputs and not test positive for false positives.

Once detected, an alert could be sent via mobile application.

**Citations and Web references**

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