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DTW Algorithm – Dementia Detection For Driving Pattern In Smart Phones

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ABSTRACT ; Dementia is a term that covers a group of symptoms that include memory loss and difficulty, as well as challenges with thinking, problem-solving, and language. Dementia is caused by disorders that break the mind, such as Alzheimer's disease or a series of strokes. There are hundreds of requests available to assist persons who have been diagnosed with dementia. However, there are no apps or multimedia that can tell a person whether or not they have dementia. To recognize dementia, approved approaches include a variety of exams and diagnostic procedures. These dementia tests often include mental ability tests, blood tests, and brain imaging. In this work, an unique technique for detecting dementia is proposed, which involves detecting repeated changes in a person's steering outline using smartphone sensors and the DTW algorithm, as well as prescribing medication before the condition deteriorates if the individual is diagnosed with dementia.
Keywords: Dementia, Alzheimer's, DTW (Dynamic Time warping), accelerometer, magnetometer, gyroscope, SMA (simple moving average).

1. INTRODUCTION

Dementia is a symptom, not a disease. It's a broad word that refers to a slew of symptoms associated with a loss of memory or other thinking skills severe enough to limit a person's ability to carry out daily chores. Due to the wide range of dementia symptoms, at least two of the following core mental functions must be considerably impaired in order to be diagnosed with dementia:

1. Memory
2. Communication and language
3. Ability to focus and wage attention
4. Reasoning and judgment
5. Visual perception

Dementia is caused by damage to brain cells. The ability of mind cells to communicate with one another is harmed as a result of this injury. When brain cells don't interact properly, it might have an impact on one's thoughts, actions, and emotions. There is no single test that can be performed to identify if someone has dementia or not. Doctors use a healthy health history, a family history of Alzheimer's disease, and a family history of dementia to diagnose Alzheimer's disease and other types of dementia.

Physical examinations, workshop examinations, and the typical changes in thinking, day-to-day purpose, and deeds connected with each type are all part of the process. Patients suffering from dementia may exhibit the following symptoms. Memory defeat – exceptionally setbacks alongside recollection for present events, such as forgetting memos, recalling paths or terms, and asking inquiries repetitively.

1. Tasks and hobbies that need association and preparation become more challenging.
2. Becoming bewildered in strange situations.
3. Finding the appropriate words is difficult.
4. Difficulty with arithmetic and/or recognising money in stores.
5. Personality and mood shifts.
6. Depression.

2. EXISTING SYSTEM

There are already android apps that help dementia patients improve their mental functions by giving a small interest such as puzzles, asking questions, and so on. Additionally, there are insufficient apps that assist dementia patients in overcoming disorientation by alerting them. However, there is no system in place to detect dementia before a person develops a catastrophic condition.

3. PROPOSED SYSTEM

We provide a strategy in the advised arrangement for detecting whether a person has dementia by recognising frequent changes in that individual's steering outline. This idea is based on the fact that Alzheimer's disease and other dementias induce changes in a person's ability to properly operate a motor vehicle. The following are a few minor changes to dementia sufferers' steering patterns:

1. Traffic infractions
2. Accidents
3. Getting lost
4. Measuring distances incorrectly
5. Forgetting the rules of the road
6. Slow response times
7. Taking an excessive amount of time to grasp an objective.
8. Unexpectedly stopping the vehicle for no apparent cause.

4. LITERATURE SURVEY

Various academics have attempted to track driver behaviour using inside-car sensors, roadside sensors, and smartphone integrated sensors.

To detect aggressive steering habits, P. Singh et al. designed an android-based programme that collects data from accelerometers, GPS, and microphone recordings. Speed breaker, lane-change left/right, left/right coil, sudden destruction, and unexpected quickening were among the outlines explored and confirmed utilising 'Ground Truth.' The audio and accelerometer data were linked to find new patterns.

Fazeen et al. proposed in [2] a unique request for assessing driver style using a mobile

Smartphone that is integrated within an automobile. They used an Android-based smartphone's three-axis accelerometer to capture and analyse a variety of driver behaviours as well as external road conditions that could be dangerous to the driver's health.

They computed the driver's manage manipulation of the vehicle as they drive, accelerate, and apply the brakes using x-axis and y-axis accelerometer data. Harmless acceleration or deceleration never exceeds ±0.3 g, whereas unexpected acceleration or deceleration exceeds ±0.5g. It's simple to measure the difference between harmless and surprising quickening or deceleration using this analogy. The average g-force produced by a harmless right/left lane is less than ±0.1 g, while a risky or unexpected right/left lane produces a g-force of much over ±0.5 g. It was discovered that a harmless lane change took 75 percent longer to complete than an unexpected lane change. The locations of phone arrangement in a car were also observed, and loc. 1, the centre console, offered the best comparison data as well as low engine feedback.

Chigurupa et al. produced an android software that integrates data from an accelerometer sensor, a GPS sensor, and video capture with the help of a camera to deliver location information to the driver in [3,]. The data can be used to help the driver enhance his or her awareness and performance. It's simple to distinguish between harmless and surprising quickening or deceleration using this analogy. The average g-force produced by a harmless right/left lane is less than 0.1 g, while a risky or unexpected right/left lane produces a g-force of much over 0.5 g. It was discovered that a harmless lane change took 75 percent longer to complete than an unexpected lane change.Harmless g worth =-3 to +3 on the Y axis, direction-left/right, steering pattern-turning/swerves/lane change, Harmless g worth =-3 to +3 on the Y axis, direction-left/right, steering pattern-turning/swerves/lane change, Harmless g worth =-3 to +3 Z-axis, driving direction (up/down) Harmless g worth =-8 to-11 for Pattern-Bumps / Road Anomalies.

Johnson et al. suggested a method for predicting steering style in [4]. Normal, hostile, and severely aggressive steering styles were identified. They gathered data from a variety of sensors (accelerometer, gyroscope, magnetometer, GPS, and video) and combined it into a single classifier based on the Vibrant Period Warping (DTW) method. MIROAD is the name of their collaboration:A Mobile-Sensor-Platform for Intelligent Credit of Hostile Driving, the system can provide audio feedback as well as data management leading up to a hostile event. They used an iPhone 4 to record events such as right, left, and U-turns, as well as hostile right, left, and U-turns, hostile quickening, and braking.

5. SYSTEM MODULES

The recommended setup is supposed to include the following modules.
1. A phone with intelligence and sensors (accelerometer, magnetometer, gyroscope).
2. Algorithm for detecting driving lines (DTW algorithm).

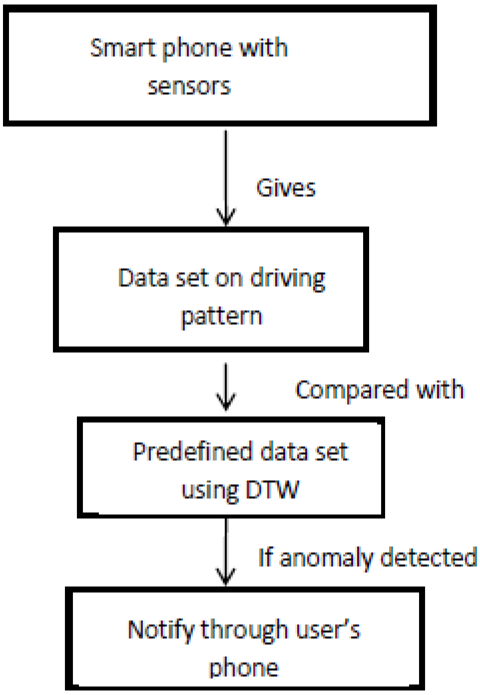

Fig .1 System architecture

6. SMART PHONE WITH SENSORS

The latest smartphones come with a plethora of functional inputs that can be scrutinized but not manipulated to:
1. The camera (often multiple)
Microphone number two (often multiple)
3. Accelerometer with three axes
4. Gyroscope with three axes
5. Proximity
6. Lighting in the Environment
7. Touch
8. Magnetometer (compass)
9. GPS
These technologies, which are influential, low-cost, and allow for variable inspection times, allow for the instrumentation of a vehicle for data collecting near the end region as well as academia. We'll focus on the rear-facing camera, accelerometer, gyroscope, and GPS in this setup (for event locale and speed only). The phone's axes are set up as indicated in Fig. 2 for mechanical gesture. To prevent the climbing arm from going forward and ensuring the camera is unobstructed, we maintain it rotated on its side and flush against the vehicle dashboard. In this arrangement, we use the sensor-fusion output of accelerometer, gyroscope, and magnetometer (compass) sensors to identify and categories vehicle movementBecause gyroscope data compute rotation rate, they provide a clearer indicator of vehicle coil movement, and by integrating the accelerometer and magnetometer with the gyroscope, we can get a more exact assessment of mechanism attitude (orientation). The accelerometer and magnetometer compensate for gravity and magnetic field, while the gyroscope detects rotation in reference to itself.

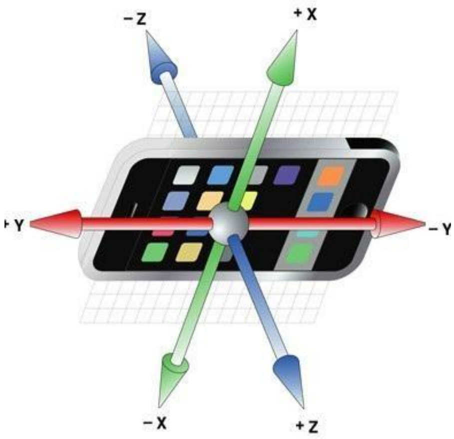

Fig. 2. The axes for accelerometer and gyroscope sensors

6. DRIVING PATTERN DETECTIONALGORITHM

There are two types of movements that can be detected: lateral (turning) T and longitudinal L movements. Mechanism gyroscope values G = gx, gy, gz in rad/s, mechanism accelerometer benefits A = axe, ay, az in m/s2, and mechanism Euler slant rotation E = ex,ey, ez in radians from a reference attitude R are included in these categories.

$T = \{g_x, a_y, e_x\}$ (1)

$L = \{g_y, a_z\}$ (2)

We chose to focus on L individually since it's easier to determine braking and acceleration by thresholding the z-axis accelerometer value separately. T = gx, gy, gz, we feel, is the best set of signals for separating events from comparable movements. On the three sets of signals stated earlier: A, G, and T, we use the DTW algorithm [4] [5][6][7][8][9][10] to detect changes in the steering pattern. The configuration continually accumulates gesture data from the accelerometer and gyroscope at a rate of 25Hz in order to detect individual moves. Hard left and right turns, swerves, and abrupt braking and speeding patterns are all attention-getting moves. We use endpoint detection to determine when a manoeuvre begins and stops. When we get a gesture that represents a manoeuvre, we compare it to previously stored manoeuvres (templates) to see if it matches an irregular steering pattern. We employ an easy advancing average (SMA) [4] of the rotational power concerning the x-axis for a window of size k from the current example I to notice when events started.

$$SMA = \frac{g_x(i)^2 + g_x(i-1)^2 + ... + g_x(i-k-1)^2}{k} \quad (3)$$

If SMA is more than a higher threshold tU, the event begins with gx(i-k-1), and the subsequent benefits of gx are concatenated until SMA is less than a lower threshold tL.

If the event lasts longer than 15 seconds, it will be discarded. Because rotation stands out more than quickening in all of our recorded instances, we chose the SMA of gx. From all three sensor sets, we create five templates for each type of occurrence, totaling 40 recording manoeuvres and 120 templates. To determine the type of event, we utilise the K-Nearest Neighbors (k-NN) association approach with k = 3. A single vehicle and driver are used to industrialise the five templates. The same endpoint detection mechanism described above is used to record templates. For each recorded occurrence, three templates for the A, G, and T sets of signals are kept simultaneously for precise comparison. The regular steering events are seized in a controlled environment for safety, whereas the abnormal steering events are seized from metropolis steering. The DTW algorithm seeks the closest match among the diverse styles of templates after attempting to determine whether a steering event is normal or abnormal. The hostile templates include high-intensity jerk movements and turns that result in traction loss. The following are examples of events that are noticed by arrangement:

1. Right turns (900)
2. Left turns (900) 3. U-turns (1800)
4. Irregular right turns (900)
5. Irregular left turns (900)
6. Irregular U-turns (1800)
7. Irregular acceleration
8. Irregular braking
9. Swerve right (Irregular lane change)
10. Swerve left (Irregular lane change)

By comparing the recorded data set to the average template, we can see if there is a change in the arrangement's steering outline. If the change occurs more than 3-4 times in a date, the individual is suspected of having dementia and is advised to visit with a doctor via his smart phone.

7. ADVANTAGES OF THE PROPOSEDSYSTEM

Through the recommended arrangement, one can recognise that he or she has dementia before the problem worsens. This primary dementia diagnosis will allow you to:

1. gain access to information, services, and support; and
2. demystify and de-stigmatize your condition.
3. Improve your quality of life by taking use of treatments
4. Benefit from treatments
5. Make a plan for the future.
6. Inform your family, friends, and associates about the changes in your life.

8. CONCLUSION

Thus, a novel method of detecting dementia by detecting changes in a person's steering outline with the help of smartphone sensors and a detection algorithm is suggested, which may aid in notifying the person if he has dementia and advising him to seek treatment so that we can avoid the critical situations that may arise as a result of late diagnosis of the illness.

9. REFERENCES

[1] Singh, P., Juneja, N., Kapoor, S.: Using mobile phone sensors to detect driving behavior. In: Proceedings of the 3rd ACM Symposium on Computing for Development, ACM (2013).

[2] Fazeen, M., Gozick, B., Dantu, R., Bhukhiya, M., Gonzalez, M.C.: Safe Driving Using Mobile Phones. EEE Transactions on Intelligent Transportation Systems(2012).

[3] Chigurupa, S., Polavarap, S., Kancherla,Y., Nikhath, K.A.:Integrated Computing System for measuring Driver Safety Index. In: International Journal of Emerging Technology and Advanced Engineering, ISSN 2250- 2459, Volume 2 (2012).

[4] Johnson, D.A., Trivedi, M.M.:Driving Style Recognition using a smartphone as a sensor platform. In: IEEE 14th International Conference on Intelligent Transportation system, October (2011).

[5] S.Jafar Ali Ibrahim, Dr. M. Thangamani, Enhanced singular value decomposition for

prediction of drugs and diseases with Hepatocellular carcinoma based on multi-source Bat Algorithm based Random walk, Journal of Measurement, Elsvier, Vol.141, July 2019.

[6] V. Ravindra Krishna Chandar, Dr. M. Thangamani, V. Ravindra Krishna Chandar, Suppression of noises using fast independent component analysis and signal saturation using fuzzy adaptive histogram equalization for intensive care unit false alarms, Journal of Measurement, Elsvier Vol.145, October 2019, Pages 400-409.

[7] Jafar Ali Ibrahim, Dr. M. Thangamani, Prediction of novel drugs and diseases for hepatocellular carcinoma based on multi-source simulated annealing based randomwalk, Journal of Medical System, Springer, Vol.42, No.188, August 2018.

[8] M. Thangamani, Dr. P. Thangaraj, Fuzzy Ontology for Document Clustering based on Genetic Algorithm, Applied Mathematics and Information Science, Vol. 4, Issue 7, pp.1563-1574, 2013, ISSN 2325-0399.

[9] M. Thangamani, R. Vijayalakshmi, M. Ganthimathi, Rajita, P. Malarkodi, S. Nallusamy, Efficient classification of heart disease using K-Means clustering Algorithm, International Journal of Engineering Trends and Technology, Vol.68, Issue.12, pp. 48-53, December 2020.

[10] S. Jafar Ali Ibrahim, Dr. M. Thangamani , Momentous Innovations in the prospective method of Drug development, Proceedings of the 2018 International conference on digital medicine and Image Processing, ACM Digital Library April 2019.