International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 3, No. 1, March - May, 2018
Pages 59-62 | Cosmos Impact Factor (Germany): 5.195
Received: 08.03.2018 Published : 30.03.2018

# Use of Behavior Based Pattern Analysis Using Kinect Sensors

**[1]Ashok D, [2]Nikhil Nagarajan, [3]Lini Varghese, [4]KP Archith**
[1]Assistant Professor, [2,3,4]UG Scholars,
Department of Computer Science and Engineering
SRM University, Chennai,India
Corresponding Author: nikhilnagarajan@icloud.com

**Abstract —** The world's digital imprint of each individual user has increased exponentially of which it may be fake or original. However facial recognition being the current forte, helps us to identify and recognise individuals through particular facial key points which was defined brilliantly in the iPhone X. Even then it is difficult to identify individuals with similar or exact features. There are increasing indications that this type of data will have great value in providing complementary information for user authentication. However, there have also seen a growing interest in broadening the predictive capabilities of biometric data, encompassing both easily definable characteristics such as subject age and, most recently, `higher level' characteristics such as emotional or mental states.

**Index Terms—** Adaptive algorithm, dynamic profiling

## I. INTRODUCTION

We have seen a huge exponential growth in cyber footprints regardless of whether the crime occured or not. Predictive analytics is the branch of the advanced analytics which is used to make predictions about unknown future events. Predictive analytics uses many techniques from data mining, statistics, modeling, machine learning, and artificial intelligence to analyze current data to make predictions about future. Using the above mentioned methods along with kinetic sensors, we shall demonstrate the use of the said method and thus improvise the current PredPol mechanism by predicting events of crime before it happens on a large scale.

Most of the applications such as traffic management system or supply chain logistics of big super markets involve large datasets which have to be analyzed in near real-time in order to make decisions. Data from different sensors is generated in the form of real-time events which often form complex patterns; where each complex pattern represents a unique event. These events are marked with an appropriate conditions and triggers when initialised it will intimate the issue.

Kinect (codenamed Project Natal during development) is a line of motion sensing input devices that was produced by Microsoft for Xbox 360 and Xbox One video game consoles and Microsoft Windows PCs. Based around a webcam-style add-on peripheral, it enables users to control and interact with their console/computer without the need for a game controller, through a natural user interface using gestures and spoken commands. This helps in generating a skeletal figure for multiple individuals and also it is easier to track and set event triggers which will then help in setting actions between two individuals.

The challenges faced by this study, is the time complexity for each action and hence only limited actions are accounted for within this study.

**A. Related Works**

In literature, We have seen individual methods and no inclusion of AI framework to establish event triggering and effective live-tracking of information. Kinect Sensors can only detect movements set by particular conditions set by the user/programmer. There was a possibility of event prediction but at the time it was deemed impossible due to incapability for handling big data.

In recent studies, handling such information as such is easier and hence we aim to employ the required methods as well. The kinect sensors works on bases of rules defined by the GDL script. This language is useful in defining the movement and the particular conditions to confirm the events. More information on the sensor will be explained in subsequent sections.

In usual surveillance procedure, it is generally focused on a particular individual when authorized by the respective officials. This surveillance was managed by Human Forces rather than the system itself. Predpol detects data which already exists although not in real-time. Usage of surveillance requires a lot of resources in order to track individuals of suspicious activities. It is usually done through manual tracking and pattern recognition through focused means.

**B.Proposed Model**

The camera and 3d depth sensor must be connected to the central server using a circuit , and the input data from the sensors and camera must flow to the central server for live streaming and detection . Along with this setup a gps must be connected to the circuit to fetch live GPS coordinates and send them to the nearest station. For the streaming any C- mount surveillance camera can be used with a preferably wider field of view , a 3D depth sensor that can record and map objects that comes under the field of view of the camera is used for the 3d mapping. However since 3D rendering takes lots of data which may not be needed we have avoided this measure until a crime has occured.

The challenges faced by this system as of the current proposal is the density of the crowd , as the density of crowd increases it becomes harder for the kinect to detect the abnormality , this will require us to use LRD and thermal cameras for which it is financially more expensive to setup a proper sensor for denser crowds. In fig:1, It shows how the system is depicted to an outsider.

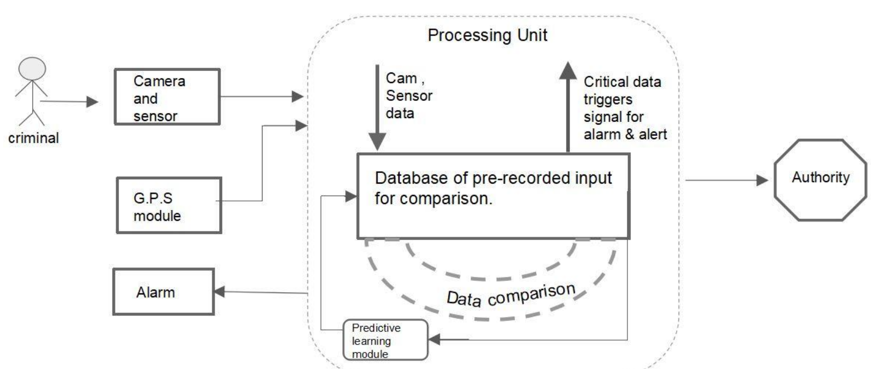


Fig 1: Architecture for proposed model

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 3, No. 1, March - May, 2018
Pages 59-62 | Cosmos Impact Factor (Germany): 5.195
Received: 08.03.2018 Published : 30.03.2018

Consider two skeletal actors A&B where A attempts to kill B. The camera detects the movement and based on the rules given by kinect's GDL script we can determine whether it is an act of killing or a false positive. This Data is then sent to a processing unit which consists of the AI framework, Database, etc. If the event of the crime is new then the system starts to learn from the action and adapts to the new action if repeated again. This way it can predict criminal activity patterns thus making it easier for authorities to catch the convict.

## II. KINECT SENSOR AND GDL SCRIPT

Kinect was first announced on June 1, 2009 at E3 2009 under the code name "Project Natal". Three demos were shown to showcase Kinect when it was revealed at Microsoft's E3 2009 Media Briefing: Ricochet, Paint Party and Milo & Kate. A demo based on Burnout Paradise was also shown outside of Microsoft's media briefing. The skeletal mapping technology shown at E3 2009 was capable of simultaneously tracking four people,with a feature extraction of 48 skeletal points on a human body at 30 Hz.

The GDL programming language is fundamentally BASIC-like. It has the same control flow statements and variable logic. In 2D and 3D in GDL, all the model elements are linked to a local right-handed coordinate system. For placing an element in the desired position, you have to move the coordinate system to the desired position (and orientation), then generate the element itself. Every movement, rotation or stretching of the coordinate system is called a transformation. Transformations are stored in a stack, which can be extended by further transformations and can be cut by deleting one or more transformations from the top of it. GDL maintains forward compatibility, which means that an ArchiCAD library part will be readable with every subsequent ArchiCAD program, but not necessarily with any earlier versions.

### C. GDL Script

The very heart of our method is an automated reasoning module. It performs forward chaining reasoning (similar to that of a classic expert system) with its inference engine any time new portion of data arrives from the feature extraction library. All rules of the knowledge base are organized in GDL scripts which are text files that are parsed with a context-free grammar. The input set of body joints and all conclusions obtained from knowledge base are put on the top of the memory heap. In addition, each level of the heap has its own timestamp which allows checking how much time has passed from one data acquisition to another. Because the conclusion of one rule might form the premise of another one, the satisfaction of a conclusion does not necessarily mean recognizing a particular gesture. The interpretation of a conclusion appearance depends on the GDL script code.
Practical entropy is used for detection of the abnormal behavior exhibited by the crowd . The kinect streamed footage is then added to a video analytic tool which uses practical entropy to detect the abnormal behavior.

### D. Units

These are Specified as Distances between two variables. Say in order to detect considerable movement all we have to check is if the current frame position of the skeletal point is variably greater than a unit distance of 20(which is measured in pixels) then the said part is moving.

International Research Journal in Global Engineering and Sciences. (IRJGES)
ISSN : 2456-172X | Vol. 3, No. 1, March - May, 2018
Pages 59-62 | Cosmos Impact Factor (Germany): 5.195
Received: 08.03.2018 Published : 30.03.2018

**E. Programming Language**

In this section we will formally define the GDL script language that is used to create the knowledge base for the inference engine. In GDL, the letter case does not matter. The GDL script is a set of rules. Each rule might have an unlimited number of premises that are connected by conjunction or alternative operators. In GDL, premises are called logical rules. A logical rule can take two values: true or false. Apart from logical rules, the GDL script also contains numeric rules (3D numeric rules) which are simply some mathematical operations that return floating-point values (or floating three-dimensional points).A numeric rule might become a logical rule after it is combined with another numeric rule by a relational operator. The brackets in logical and numeric (3D) rules are used to change the order in which instructions are executed.

An example for GDL script is as follows:

```
RULE abs(HandRight.z[0] - Head.z[0]) < 200 THEN HandZHead
RULE ElbowRight.x[0] > Spine.x[0] & WristRight.x[0] > Spine.x[0]
& WristRight.y[0] > ElbowRight.y[0] & abs(WristRight.x[0] - ElbowRight.x[0]) < 50 & HandZHead
THEN WavingGestureCenter
RULE ElbowRight.x[0] > Spine.x[0] & WristRight.x[0] > Spine.x[0]
& WristRight.y[0] > ElbowRight.y[0] & WristRight.x[0] - ElbowRight.x[0] <= -50 & HandZHead
THEN WavingGestureLeft
RULE ElbowRight.x[0] > Spine.x[0] & WristRight.x[0] > Spine.x[0]
& WristRight.y[0] > ElbowRight.y[0] & WristRight.x[0] - ElbowRight.x[0] >= 50 & HandZHead
THEN WavingGestureRight
RULE sequenceexists("[WavingGestureLeft,2][WavingGestureCenter,2][WavingGestureRight,2]")
THEN WavingRight
RULE sequenceexists("[WavingGestureRight,2][WavingGestureCenter,2][WavingGestureLeft,2]")
THEN WavingLeft
RULE (WavingRight | WavingLeft) & HandZHead THEN Waving!
```

**REFERENCES**

[1] Predictive Biometrics:A Review and Analysis of Predicting Personal Characteristics of Biometric Data(IEEE Paper)
[2] Application Specific Customization of Dynamic Profiling Mechanisms for Sensor Networks(IEEE Paper)
[3] Abnormal behavior detection using a novel behavior representation (IEEE paper)
[4] Almost Everything You Always Wanted to Know About 3D Scanning (Article on dirdim.com)
[5] 3D - scanning , Behaviour analysis , Machine learning wikis (wikipedia.org)
[6] Real-Time Hand Gesture Recognition Using Finger Segmentation (Research article on hindawi.com)
[7] Simple Hand Gesture Recognition using OpenCV and JavaScript (Article on medium.com)
[8] Predictive Analytics for Complex IoT Data Streams (IEEE Paper)
[9] www.cci.up.krakow.pl(GDL)
[10] www.unrealengine.com/marketplace/kinect-4-unreal-introduction(Unreal Engine)
[11] Rule-based approach to recognizing human body poses and gestures in real time-Tomasz Hachaj (https://link.springer.com/article/10.1007%2Fs00530-013-0332-2)