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USING MISSILE'S RGB-D SENSORS TO TRACK ENEMY ARMY IN ORDER TO DECREASE CIVILIAN'S CASUALTY IN MISSILE WAR

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ABSTRACT

As technology grows, it changes everything and war is not a difference. Using human resource in direct battle has cost, so for decreasing human death, far distance battles takes advantage, and in this field, missiles have priority. All the controllable missiles have GPS and a visual camera in the rocket tip or warhead, which uses image processing techniques to track and hit. By increasing such a war in the world, especially in Middle East, and with the aim of reducing civilian's mass destruction, this paper proposed a new method. The method uses depth or range cameras beside of color ones to increase the accuracy and better functionality on the day and night time, for preventing civilian's death. Depth sensor which is attached to the tip of missile, must distinguish civilians from enemy clothing and texture patterns and change the way if target was civilians or just terminate the functionality of the missile with the help of color sensor. For testing the system, Kinect V.2 is employed as color and range sensor and it will work with any other infrared sensors based on proposed theory. The infrared cameras could calculate distance in day or night time which is so crucial in missile war. Features like Speeded-Up Robust Features (SURF), Local Phase Quantization (LPQ) and Local Binary Patterns (LBP) are employed along with K-Nearest Neighbour (K-NN) and Support Vector Machine (SVM) classifiers for fast detection because missiles are so fast and time matters. Moreover, Kalman tracking is used for tracking moving enemies. For validating, a database is collected from internet plus self-made data are recorded using Kinect V.2 sensor. Achieved results show the fast recognition and action during test or validation phase. This method could be used in real environment and with stronger devices, but the base is same.

Keywords: missile; image processing; depth sensor; Kinect V.2; Kalman filter tracking; support vector machine;

1. INTRODUCTION

1.1 Importance of the research

Increase in war in the world and especially in Middle East resulted in large number of casualties, especially in civilians. Armies tend to use far battles to decrease solders' casualties; because human resource is very important in the war. Without having human resource, continuing war is useless and impossible. When war is placed in cities full of civilians, then human resource is in great danger. Hence, to eliminate enemies, using rockets, bombs and missiles is so dangerous, just because of civilian's death possibility. Imagine a home full of terrorists and the place is marked by army and army tries to use bomb on the building, but at the same time this house is beside of the road and a market full of disarmed people and children. Using bomb going to eliminate all the terrorists in the building in a split of the second, but it will affect the people surrounded by it, that is not legal and is a war crime too [1, 2]. Thus, what is the best way to eliminate the terrorists? Clearly using an intelligent missile with precise accuracy and limited power of explosion is needed to just effect the terrorists in the building not outside of it. Well, there are a lot of missiles with this technology which get benefits of image processing and artificial intelligence (AI) techniques to track and hit the target. Using depth image to calculate the distance between missile tip (camera) and subjects (enemies) is very useful, especially if depth sensor benefits infrared technology to cover the night time. It will increase the accuracy in day and night time and decreases the casualty of civilians, which is the main goal of this research. Controllable smart missiles, may need to change the path or perform self-destruction for number of reasons, sometimes. For instance, imagine a moving car full of terrorists (detected by army) which is in front of another car full of civilians; and suddenly in moments before impact, two cars get closer to each other and in the other hand the missile is reaching to the target with a high velocity and speed. In this condition, the probability of civilian's damage is so high and there is no way back for the missile, and missile's user detects the danger. The only way to stop the accident is to stop, deactivate or miss-direct the

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missile, which must be performed by the missile's user. As it is clear in mentioned statements, using controllable smart missiles is very important in the missile war, if there is a bit of humanity inside us.

Paper is divided into 5 sections. Section 1 discusses the fundamentals and Section 2 covers the prior works done by other researchers related to the proposed subject. Section 3 pays to proposed method in detail and Section 4 covers all achieved results from evaluations and validations using proposed method. Finally, Section 5 includes, conclusion, discussion and suggestions for future works.

1.2 Depth image

Depth or range images are some type of images, which are recorded using sensors enabled to calculate distance between object and sensor [3, 4]. It means in depth image, each pixel is representative of distance in different units, and depends on recording sensor. In Kinect this unit is in millimetre and in Kinect V.2 recording distance for depth image is in range of 0.8-5 meter. For example, 1200-millimetre pixel value in Kinect depth image, means that part of object has 1.2 meter distance from the sensor. Kinect [5] is one of the Microsoft corporation products in 2014 and due to its price and accuracy, it is one of the most popular depth sensors in the world. The similar experiment is simulated with Kinect V.2 sensor, but it will be more effective with other depth sensors for long distance in real war. Kinect covers just 5 meter of depth in similar form of other long-distance depth sensors, thus, accruing satisfactory results using this sensor, proves the theory. Figure 1 shows a mortar or bomb found from Qaleh-ye Mohammad Ali Khan's [6] desert. This bomb had been used in the military manoeuvres, almost 40 years ago and did not worked well. Kinect V.2 has been used to sampling from it in color and depth form. It is clear in Figure 1, Pixel value = 821 has closest distance with the sensor and show 0.821 meter distance with the sensor and pixel value = 1233 has farthest (1.233 meter distance) and it represents wall behind the bomb which is pre-processed.

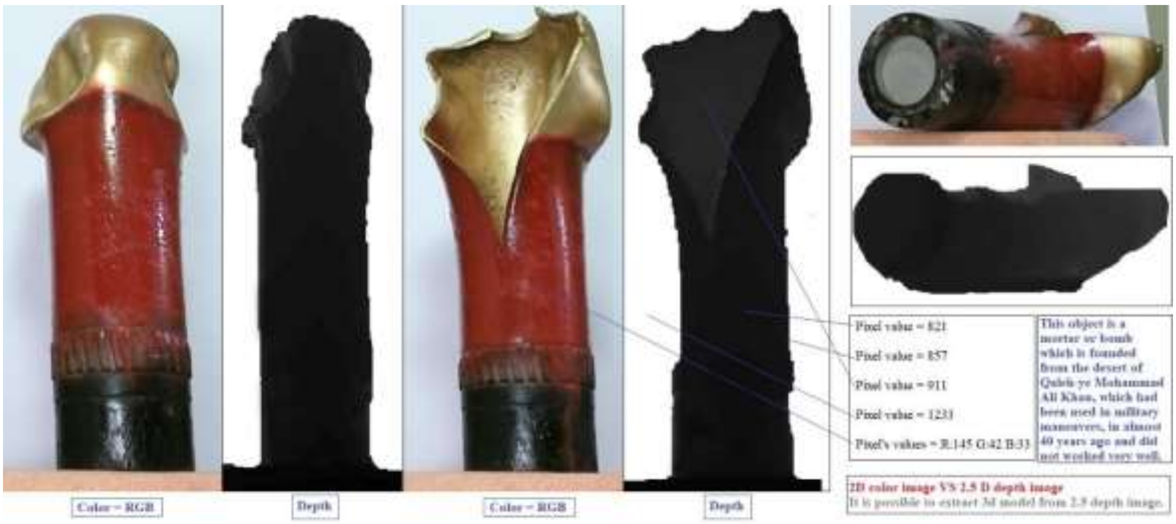

Figure. 1 A real mortar or bomb in color and depth form and in three view

1.3 Missile

A missile is a self-propelled system, as opposed to an unguided self-propelled munition, referred to as a rocket (although these can also be guided). Missiles have four system components: targeting or missile guidance, flight system, engine, and warhead. Missiles come in types adapted for different purposes: surface-to-surface and air-to-surface missiles (ballistic, cruise, anti-ship, anti-tank, etc.), surface-to-air missiles (and anti-ballistic), air-to-air missiles, and anti-satellite weapons. The first missiles, to be used operationally, were a series of missiles developed by Nazi Germany in World War II.

Missiles may be targeted in a number of ways. The most common method is to use some form of radiation, such as infrared, lasers or radio waves, to guide the missile onto its target. This radiation may emanate from the target (such as the heat of an engine or the radio waves from an enemy radar), it may be provided by the missile itself (such as a radar), or it may be provided by a friendly third party (such as the radar of the launch vehicle/platform, or a laser designator operated by friendly infantry). Many missiles use a combination of two or more of the above methods to improve accuracy and the chances of a successful engagement.

Another method is to target the missile by knowing the location of the target and using a guidance system such as INS, TERCOM or satellite guidance. This guidance system guides the missile by knowing the missile's current position and the position of the target, and then calculating a course between them. This job can also be performed somewhat crudely by a human operator who can see the target and the missile and guide it using either cable- or radio-based remote control, or by an automatic system that can simultaneously track the target and the missile [7]. Figure 2 represents Sejjil missile specification (in details) made by Hassan Tehrani Moghaddam [8], which is one of the strongest missiles (in any aspect) exist in the world till now. Figure 3 shows some types of missile homing or ways to find the target.

The first missiles to be used operationally were a series of missiles developed by Nazi Germany in World War II. Most famous of these are the V-1 flying bomb and V-2 rocket, both of which used a simple mechanical autopilot to keep the missile flying along a pre-chosen route. Less well known were a series of anti-shipping and anti-aircraft missiles, typically based on a simple radio control (command guidance) system directed by the operator. However, these early systems in World War II were only built in small numbers.

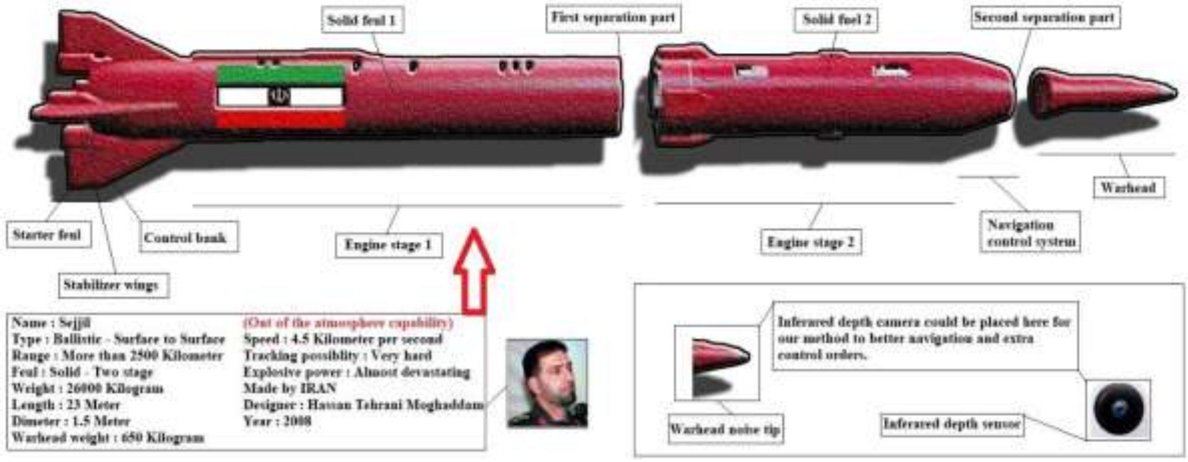

Figure. 2 Sejjil missile specification

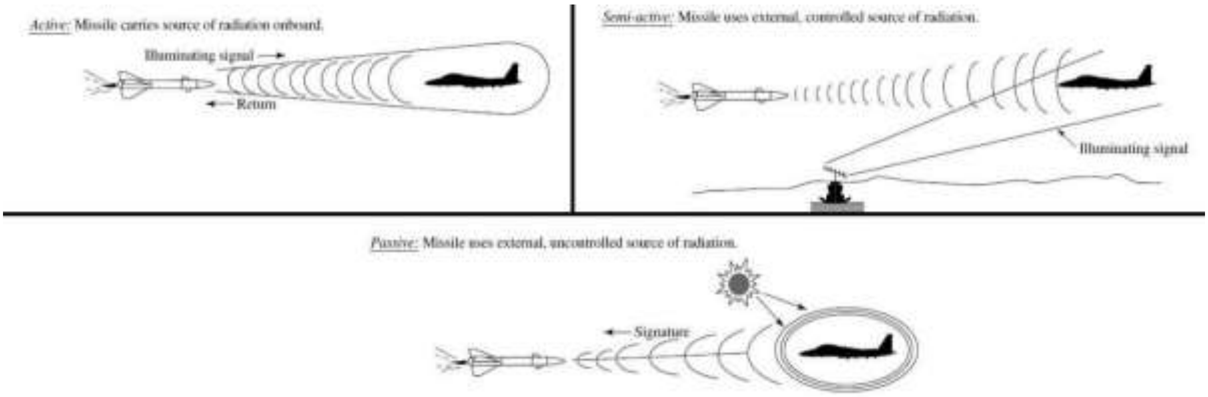

Figure. 3 Three types of missile homing [7]

1.4 Object tracking and recognition

Video frame tracking is the process of locating a moving object over time using a sensor. It has a variety of uses, such as: Human Computer Interaction (HCI), security and surveillance, video communication and compression, Augmented Reality (AR), traffic control, medical imaging [9] and video editing [10] [11]. Video tracking can be a time-consuming process due to the amount of data that is contained in video. Adding further to the complexity is the possible need to use object recognition techniques for tracking, a challenging problem in its own right. First step of object recognition is object detection. Object detection is the process of detecting something specific from other objects in the scene and object recognition is recognizing which one of these objects is the desired one. For example, we are just looking for Sejjil missile in a scene full of missiles and tanks. The process of distinguishing missiles from tanks is object detection and the process of distinguishing Sejjil missile from other type of missiles is object recognition which occurs after object detection process. Now if there be sequentially frames of moving tanks and missiles, and we be looking for Sejjil missile in each frame, then it is called missile tracking (here specifically, Sejjil missile tracking).

Tracking missile is called Missile guidance. Missile guidance refers to a variety of methods of guiding a missile or a guided bomb to its intended target. The missile's target accuracy is a critical factor for its effectiveness. Guidance systems improve missile accuracy by improving its "Single Shot Kill Probability" (SSKP), which is part of combat survivability calculations associated with the salvo combat model [12] [7]. Figure 4 shows detecting and tracking process for GBU-24 Paveway III missile in 3 frames.

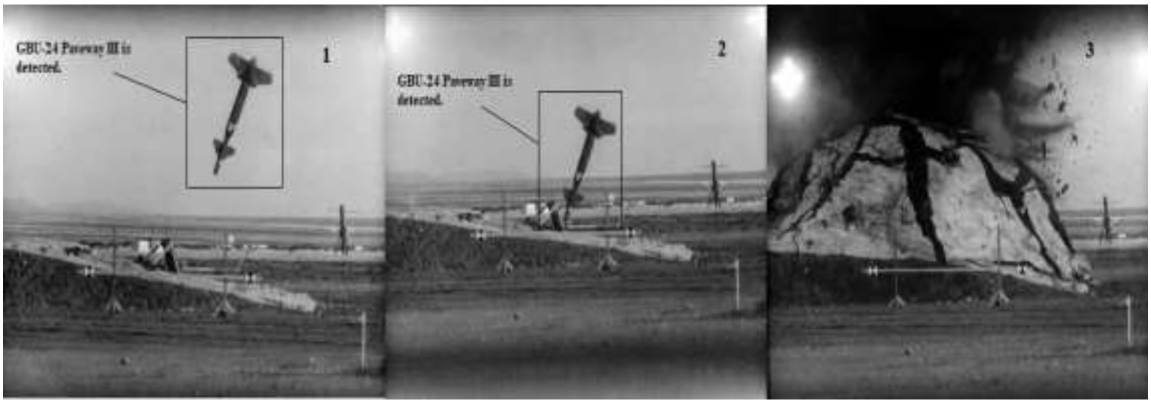

Figure. 4 Detecting and tracking process for GBU-24 Paveway III missile in 3 frames (left to right)

2. PRIOR ACTIVITIES

In 2002, Cooperman, Robert L, developed a tactical ballistic missile tracker within an Interacting Multiple Model (IMM) framework [13]. Haker, Steven, et al, applied a knowledge-based segmentation method developed for still and video images to the problem of tracking missiles and high-speed projectiles in 2001 [14]. They used MAP classification algorithm for classification task. Another mentionable work on tracking missile is Oshman, Yaakov, and David Arad work in 2004. They investigated the idea of enhancing the missile's interception performance by utilizing information on target orientation, acquired in real time by an imaging sensor [15]. Siouris, George M et al, presented computer simulation to show the effectiveness of the Extended Interval Kalman Filter (EIKF) algorithm for uncertain and nonlinear ballistic missile tracking problem in 1997 [16]. Mosavi, Asadpour & Ameri, designed and simulated a method to assess the effectiveness of IR seeking missile in presence of IR jammer sources on a developed program [17] in 2007. In 2004, Saulson, Brian, and Kuo Chu Chang used different types of Kalman filters for missile tracking purpose. They compared the performance of Extended Kalman Filter (EKF) and Unscented Kalman Filter (UKF) to the coordinate conversion problem within the larger problem of ballistic missile tracking under various sensor configurations, target dynamics, measurement update/sensor communication rates, and measurement noise [18]. Redman, Brian C., et al, used infrared points for Anti-ship missile tracking with a chirped amplitude modulation ladar in 2004. The principles of operation for the chirped AM ladar for range and velocity measurements, the ladar performance model, and the top-level design for the Phase I breadboard are presented by their paper [19]. Wells, Lawrence L in 1981 made a system for real-time tracking of long-range missiles based on use of the Global Positioning System (GPS) [20], which was very interesting.

3. PROPOSED METHOD

Paper presents, a method to decrease civilians' casualty in missile war, which the main importance happens some moments before impact. System assembly takes place before launching the missile. First, main color and depth data from destination target should be collected through geographical satellites (like google map for color data and infrared satellites for depth data). After collecting data, feature extraction using Speeded-Up Robust Features (SURF) [21], Local Phase Quantisation (LPQ) [22] and Local Binary Patterns (LBP) [23] algorithms that perform for color and depth data respectively. After fusion of extracted features, there are just two classes of friend and foe. Training classes using K Nearest Neighbour (K-NN) [24] and Support Vector Machine (SVM) [25] algorithms is next step. Test data is real target in the war. After making system ready for real experiment, it is time to launching the missile. When missile reached to the target destination, color and depth sensors will be activated for sensing. Now it is to detect, track and hitting the target. Detection for color data are performed by Viola & Jones algorithm and same process for depth data performed by pre-trained process. In tracking process using Kalman filter and in each frame (last 100000 frames), following question "Is target close to the civilians?" MUST be asked. Depth sensors provide distance between subject and sensor, here subject is target and sensor is depth device in front of the missile. Thus, in each frame of tracking calculating distance with target is possible.

Here, the word "civilian" is mentioned to any type of none-foe object in the explosion environment, which could be human, car and building, which does not belong to foe. If condition not satisfies, target should be destroyed and if satisfies, missile should be terminated or miss directed. For sure, with using high speed missile, high frame sensor is essential (frames such 10000-100000). Figure 5 shows proposed method flowchart.

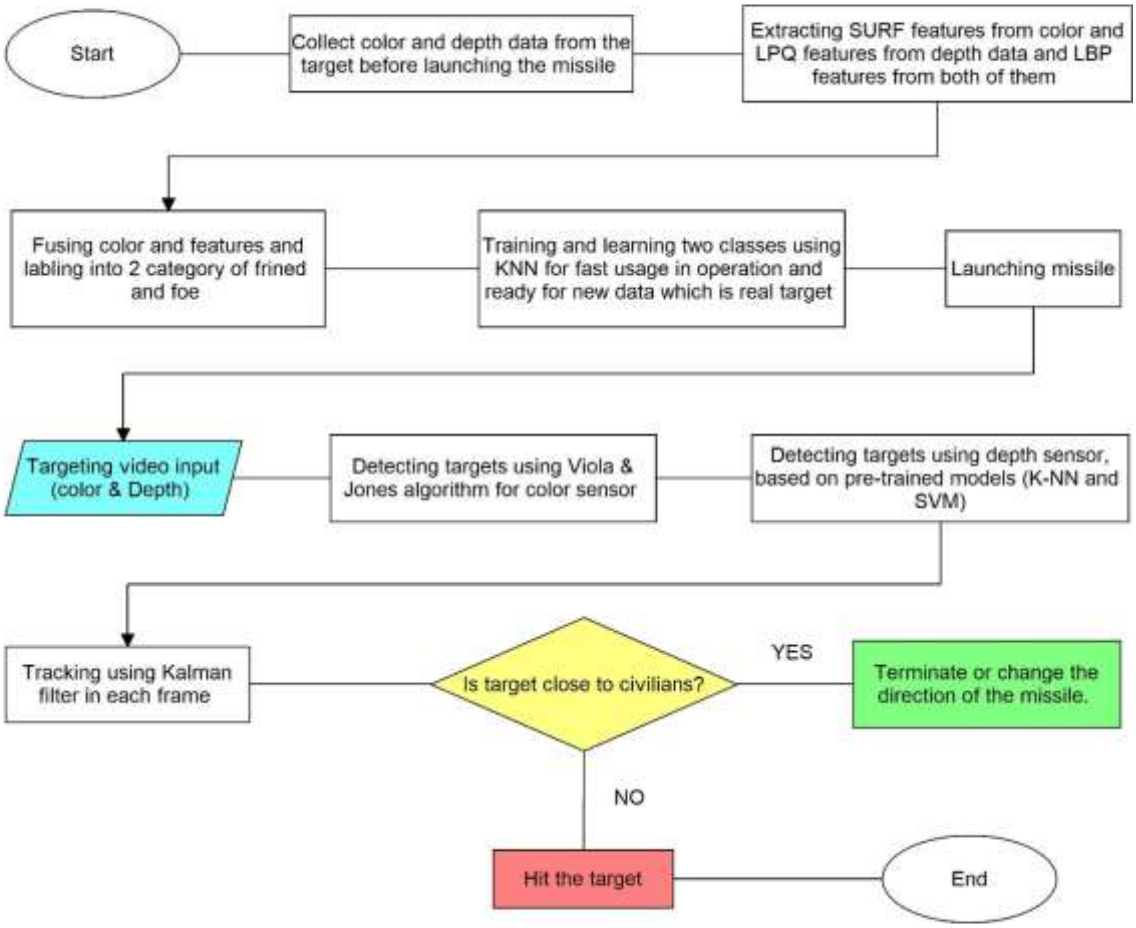

Figure. 5 Proposed method's flowchart

3.1 Viola and Jones algorithm

This algorithm is made by Paul Viola and Michael Jones in 2001 [26]. Algorithm is mainly used for face detection purposes, but it could be used for detecting any other objects. Algorithm consists of 4 main parts as follow:

1. Haar Feature Selection
2. Creating an Integral Image
3. Adaboost Training
4. Cascading Classifier

3.2 Speeded-up robust features

Speeded-up robust features (SURF) is a patent local feature detector and descriptor. It can be used for tasks such as object recognition, image registration, classification or 3D reconstruction. It is partly inspired by the Scale-Invariant Feature Transform (SIFT) descriptor [21]. The standard version of SURF is several times faster than SIFT and claimed by its authors to be more robust against different image transformations than SIFT.

To detect interest points, SURF uses an integer approximation of the determinant of Hessian blob detector, which can be computed with 3 integer operations using a pre-computed integral image. Its feature descriptor is based on the sum of the Haar wavelet response around the point of interest. These can also be computed with the aid of the integral image. SURF descriptors have been used to locate and recognize objects, people or faces, to reconstruct 3D scenes, to track objects and to extract points of interest. SURF was first presented by Herbert Bay, et al [27]. The steps are as follow:

1. Calculating integral image to increase computation speed
2. Calculating feature points by Hessian matrix [28]
3. Forming the scale space
4. Determining Extremum points
5. Making final feature vector

3.3 Local phase quantization

Local phase quantization (LPQ) [22] is a local feature and descriptor, which could be gained from phase spectrum in Fourier transform [29]. Using blur filters on phase spectrum of a depth image, has no much effect, thus, extracting feature from phase spectrum of depth image using LPQ is completely logical. The functionality of LPQ is so similar to Local Binary Patterns (LBP) [23], but in frequency domain. Figure 6 shows workflow of LPQ feature extraction algorithm.

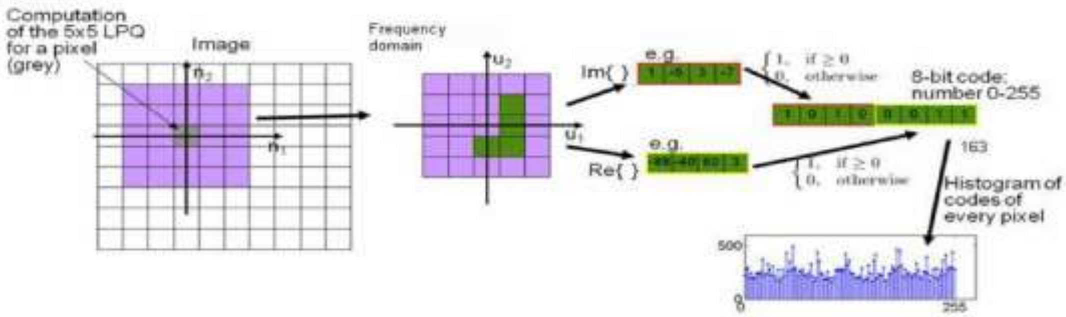

Figure. 6 Workflow of LPQ feature extraction algorithm (left to right) [30]

3.4 Local binary patterns

It is one of the strongest features to analyse the texture of an image. This feature has good capability to deal with different illuminations. Local binary patterns (LBP) is a type of visual descriptor used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990 [23], and It has been found to be a powerful feature for texture classification. LBP works by comparing pixels value by neighbour pixels values in a for example a 3*3 block on whole image. Finally putting histogram of final block together makes final histogram feature. Figure 7 presents the workflow for LBP using a sample.

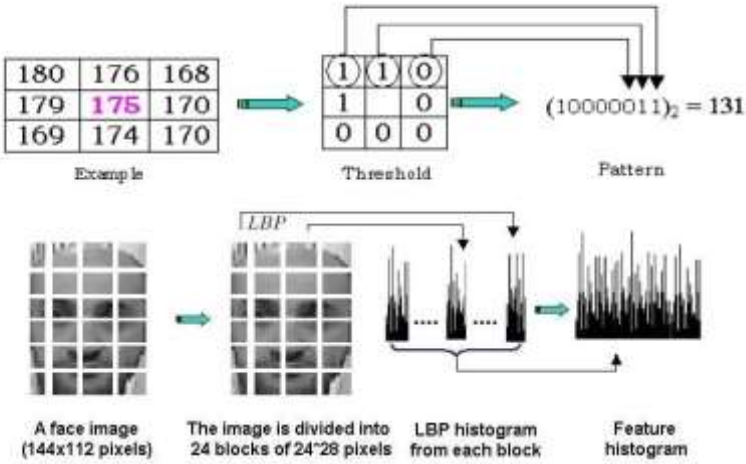

Figure. 7 Workflow of LBP feature using an example [31]

3.5 Kalman filter

Kalman filtering [32], also known as linear quadratic estimation (LQE), is an algorithm that uses a series of measurements observed over time, containing statistical noise and other inaccuracies, and produces estimates of unknown variables that tend to be more accurate than those based on a single measurement alone, by estimating a joint probability distribution over the variables for each timeframe. The filter is named after Rudolf E. Kálmán, one of the primary developers of its theory.

The Kalman filter has numerous applications in technology. A common application is for guidance, navigation, and control of vehicles, particularly aircraft and spacecraft [32]. Furthermore, the Kalman filter is a widely applied concept in time series analysis used in fields such as signal processing and econometrics. Kalman filters also are one of the main topics in the field of robotic motion planning and control, and they are sometimes included in trajectory optimization.

The algorithm works in a two-step process. In the prediction step, the Kalman filter produces estimates of the current state variables, along with their uncertainties. Once the outcome of the next measurement (necessarily corrupted with some amount of error, including random noise) is observed, these estimates are updated using a weighted average, with more weight being given to estimates with higher certainty. The algorithm is recursive. It can run in real time, using only the present input measurements and the previously calculated state and its uncertainty matrix; no additional past information is required. Figure 8 represents, Kalman filter estimation process through time. Figure 9 presents, proposed Inferred (IR) tracking system assembly on the missile.

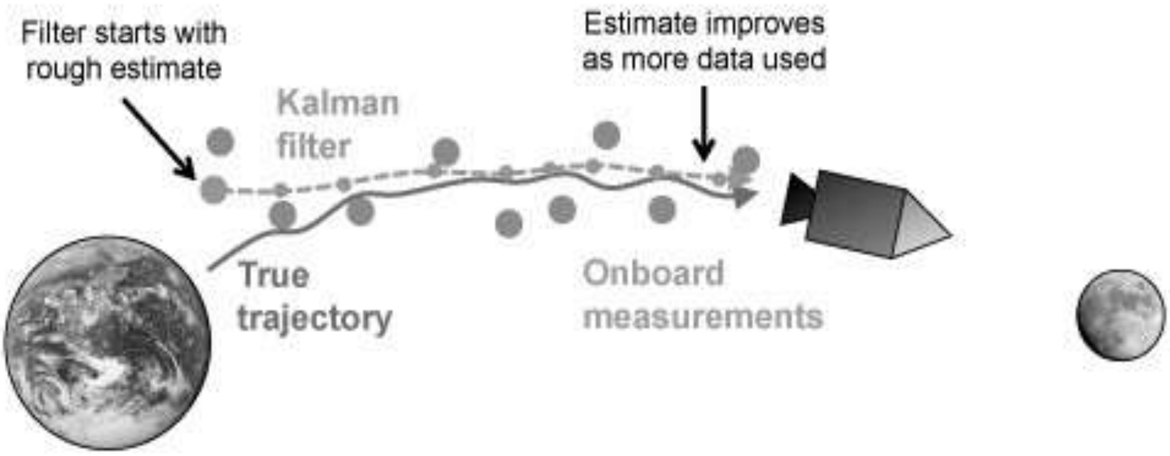

Figure. 8 Kalman filter estimation improvement process through time

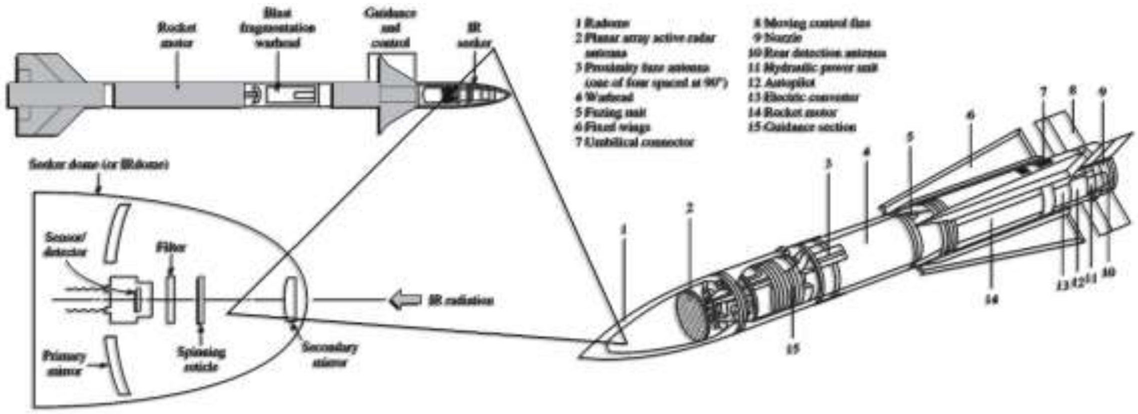

Figure. 9 Proposed Inferred (IR) tracking system assembly on a missile model

4. VALIDATION AND RESULTS

A small data collected for train and test purposes. Data is a collection of humans, cars and buildings, consisting of 20 human, 12 cars and 6 buildings and is recorded using Kinect V.2 sensor in color and depth format. Some aid of internet is received for better diversity. Classification task is performed using K-NN and SVM classification algorithms for faster decision before impact point. As missile has high velocity and K-NN is one of the fastest classification algorithms and there are just two classes of friend and foe, this system works so fast and precise before impact point (SVM is a little bit slower). Classification will be done in 3 different ranks, and in each rank, data increases.

4.1 K-Nearest Neighbor's algorithm

K-Nearest Neighbor's algorithm (K-NN) is a non-parametric method used for classification and regression [24]. In both cases, the input consists of the k closest training examples in the feature space. The output depends on whether K-NN is used for classification or regression.

In K-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of that single nearest neighbor. K-NN is a type of instance-based learning, or lazy learning, where the function is only approximated locally and all computation is deferred until classification. The K-NN algorithm is among the simplest of all machine learning algorithms. Figure 10 shows a simple example of K-NN algorithm for two classes of friend and foe. New circular sample with question mark which is test data belongs to foe class in k=1 and k=3, Due to number of foe samples in the k range. But if k be bigger, like whole the scene, then new sample belongs to the friend class.

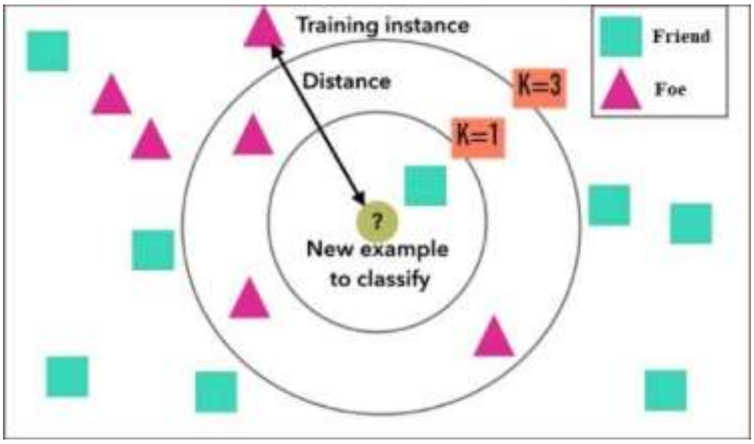

Figure. 10 Simple version and example of K-NN classification algorithm with two classes

4.2 Support vector machine

Support vector machines (SVM) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. Given a set of training examples, each marked as belonging to one or the other of two categories, an SVM training algorithm builds a model that assigns new examples to one category or the other, making it a non-probabilistic binary linear classifier. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible. New examples are then mapped into that same space and predicted to belong to a category based on which side of the gap they fall. There are samples as support vectors and samples as outliers and also normal samples [25]. Figure 11 presents the simple linear SVM with two classes.

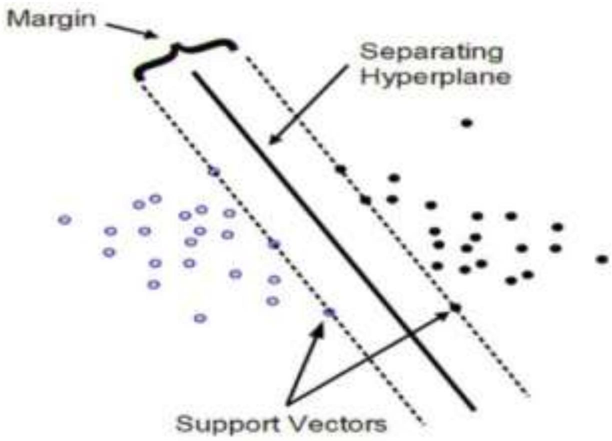

Figure. 11 Simple version of SVM classification algorithm using two classes

4.3 Classification result

For each element of data, confusion matrix is calculated using K-NN and SVM classification algorithms, and finally for whole data. As it said before, there are just two classes of friend and foe for fast decision before impact point. Classification takes place for three ranks of 25%, 75% and 100% data. Tables 1, 2, 3 and 4, shows classification results in three ranks using K-NN algorithm for human, car, building and whole data respectively. Final error for whole data and for two classes of friend and foe is 2 and 1.9, respectively, which beside of its magnificent speed, shows robustness of the system. Tables 5, 6, 7 and 8, presents classification results in three ranks using SVM algorithm for human, car, building and whole data respectively, which as it is clear, SVM performed a little bit better than K-NN in mentioned Tables. Proposed method's runtime speed in all tests was around 0.2 second. Figure 12 represents error percentage for each class in detail. It is clear in Figure12, as rank's value gets higher, recognition accuracy gets lower mostly. But even in rank 3 and in worst condition, error percentage of 2 is recorded for whole data.

Table. 1 Confusion matrix for human data in three rank and for two classes of friend and foe with K-NN

K-NN	Human	Friend	Foe
Rank 1 (25 %)	Friend	99.1 %	0.9 %
-	Foe	0 %	100 %
Rank 2 (75 %)	Friend	99.3 %	0.7 %
-	Foe	0.2 %	99.8 %
Rank 3 (100 %)	Friend	98.4 %	1.6 %
-	Foe	1 %	99 %

Table. 2 Confusion matrix for car data in three rank and for two classes of friend and foe with K-NN

K-NN	Car	Friend	Foe
Rank 1 (25 %)	Friend	99.4 %	0.6 %
-	Foe	0.8 %	99.2 %
Rank 2 (75 %)	Friend	99.2 %	0.8 %
-	Foe	1 %	99 %
Rank 3 (100 %)	Friend	99.1 %	0.9 %
-	Foe	1.5 %	98.5 %

Table. 3 Confusion matrix for building data in three rank and for two classes of friend and foe with K-NN

K-NN	Building	Friend	Foe
Rank 1 (25 %)	Friend	98.7 %	1.3 %
-	Foe	0 %	100 %
Rank 2 (75 %)	Friend	99.2 %	0.8 %
-	Foe	1.2 %	98.8 %
Rank 3 (100 %)	Friend	98.7 %	1.3 %
-	Foe	0.7 %	99.3 %

Table. 4 Confusion matrix for whole data in three rank and for two classes of friend and foe with K-NN

K-NN	Whole data	Friend	Foe
Rank 1 (25 %)	Friend	98.9 %	1.1 %
-	Foe	1.4 %	98.6 %
Rank 2 (75 %)	Friend	97.3 %	2.7 %
-	Foe	1 %	99 %
Rank 3 (100 %)	Friend	98.1 %	1.9 %
-	Foe	2 %	98 %

Table. 5 Confusion matrix for human data in three rank and for two classes of friend and foe with SVM

SVM	Human	Friend	Foe
Rank 1 (25 %)	Friend	99.7 %	0.3 %
-	Foe	0 %	100 %
Rank 2 (75 %)	Friend	99.9 %	0.1 %
-	Foe	0.2 %	99.8 %
Rank 3 (100 %)	Friend	99.4 %	0.6 %
-	Foe	100 %	0 %

Table. 6 Confusion matrix for car data in three rank and for two classes of friend and foe with SVM

SVM	Car	Friend	Foe
Rank 1 (25 %)	Friend	99.6 %	0.4 %
-	Foe	0.9 %	99.1 %
Rank 2 (75 %)	Friend	99.2 %	0.8 %
-	Foe	2 %	98 %
Rank 3 (100 %)	Friend	99.3 %	0.7 %
-	Foe	1.1 %	98.9 %

Table. 7 Confusion matrix for building data in three rank and for two classes of friend and foe with SVM

SVM	Building	Friend	Foe
Rank 1 (25 %)	Friend	98.9 %	1.1 %
-	Foe	0 %	100 %
Rank 2 (75 %)	Friend	100 %	0 %
-	Foe	0.7 %	99.3 %
Rank 3 (100 %)	Friend	99.5 %	0.5 %
-	Foe	0.8 %	99.2 %

Table. 8 Confusion matrix for whole data in three rank and for two classes of friend and foe with SVM

SVM	Whole data	Friend	Foe
Rank 1 (25 %)	Friend	99.9 %	0.1 %
-	Foe	0.4 %	99.6 %
Rank 2 (75 %)	Friend	98.3 %	1.7 %
-	Foe	0.9 %	99.1 %
Rank 3 (100 %)	Friend	99.6 %	0.4 %
-	Foe	1.2 %	98.8 %

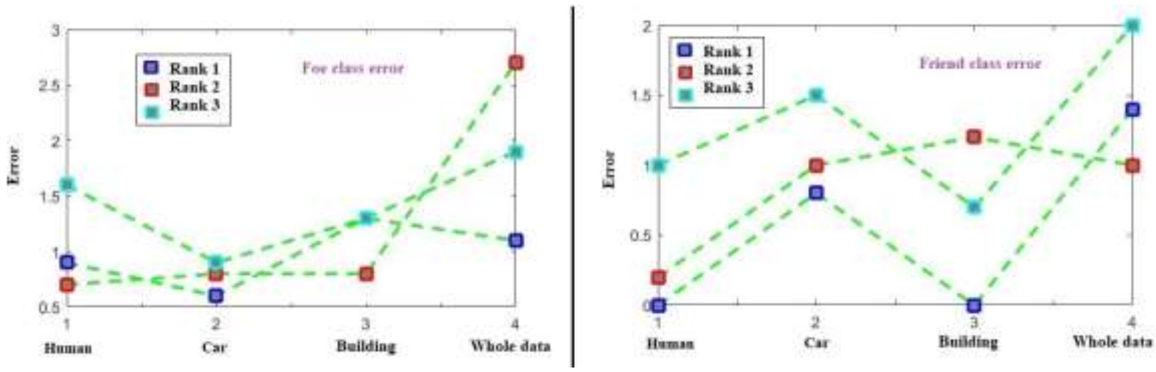

Figure. 12 Error percentage for each class based on data type and rank value

5. CONCLUSION

After destroying all the earth's ecosystem, now it is time to destroy our selves by technology. Using missiles is completely beneficial in today's wars. Sending a tanker of explosive material with computer aid rises from such sick minds or for self-defence (best approach). Any ways they exist and we are using them in the wars. But as technology helped us to made them, it will help us to make them more precise and in better definition, and more intelligent. The paper proposed a fast and robust method to use RGB-D sensors in missile's warhead to increase accuracy for decreasing human (civilians) casualty in missile war (as theory). As the result section shows the effectiveness of our method using a simple sensor like Kinect V.2, it could be assembled on the real missiles but with stronger IR sensors and with higher frame rate. Groups like ISIL (Daesh) are a bug, which must be fixed.

But they are mostly among civilians for self-protection. As countries like Iran made missiles with 100% accuracy for decreasing civilian's casualty, with adding this method to the existing missiles, effectiveness increases. It is suggested to use this system in real experiment and with real missiles for assessment. Dream to a day in which world will be full of peace and not a single war. Dream to a day, that we respect to each other till nature respects us. Dream to a day, may God save us from this madness and bloodshot with a saviour.

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REFERENCES

1. Cassese, Antonio, et al. *International criminal law: cases and commentary*. Oxford University Press, 2011.
2. Arsanjani, Mahnoush H. "*The Rome statute of the international criminal court*." American Journal of International Law 93.1 (1999): 22-43.
3. Lun, Roanna, and Wenbing Zhao. "*A survey of applications and human motion recognition with Microsoft kinect*." International Journal of Pattern Recognition and Artificial Intelligence 29.05 (2015): 1555008.
4. Foix, Sergi, Guillem Alenya, and Carme Torras. "*Lock-in time-of-flight (ToF) cameras: A survey*." IEEE Sensors Journal 11.9 (2011): 1917-1926.
5. Zhang, Zhengyou. "*Microsoft kinect sensor and its effect*." IEEE multimedia 19.2 (2012): 4-10.
6. https://www.google.com/maps/place/Qaleh-ye-Mohammadalikhan,+Qom+Province/@35.2528124,50.9774531,1137m/data=!3m1!1e3!4m5!3m4!1s0x3f926b128fae84b3:0xb47bdf3ce2e0123!8m2!3d35.2527157!4d50.9797343
7. Siouris, George M. *Missile guidance and control systems*. Springer Science & Business Media, 2004.
8. https://en.wikipedia.org/wiki/Hassan_Tehrani_Moghaddam
9. Mountney, Peter, Danail Stoyanov, and Guang-Zhong Yang. "*Three-dimensional tissue deformation recovery and tracking*." IEEE Signal Processing Magazine 27.4 (2010): 14-24.
10. Mihaylova, Lyudmila, et al. "*Object tracking by particle filtering techniques in video sequences*." Advances and challenges in multisensor data and information processing 8 (2007): 260-268.
11. Kato, Hirokazu, and Mark Billinghurst. "*Marker tracking and hmd calibration for a video-based augmented reality conferencing system*." Augmented Reality, 1999. (IWAR'99) Proceedings. 2nd IEEE and ACM International Workshop on. IEEE, 1999.
12. Kopp, Carlo. "*Active and Semi-Active Radar Missile Guidance*." Australian Aviation 1982.June (1982).
13. Cooperman, Robert L. "*Tactical ballistic missile tracking using the interacting multiple model algorithm*." Information Fusion, 2002. Proceedings of the Fifth International Conference on. Vol. 2. IEEE, 2002.
14. Haker, Steven, et al. "*Missile tracking using knowledge-based adaptive thresholding*." Image Processing, 2001. Proceedings. 2001 International Conference on. Vol. 1. IEEE, 2001.
15. Oshman, Yaakov, and David Arad. "*Enhanced air-to-air missile tracking using target orientation observations*." Journal of guidance, control, and dynamics 27.4 (2004): 595-606.
16. Siouris, George M., Guanrong Chen, and Jianrong Wang. "*Tracking an incoming ballistic missile using an extended interval Kalman filter*." IEEE Transactions on Aerospace and Electronic Systems 33.1 (1997): 232-240.
17. Mosavi, ; Asadpour & Ameri, ۱۳۸۶, *Design and Simulation of an Infrared Jammer Source for an Infrared Seeker*, **اولین کنفرانس داده کاوی ایران, تهران, دانشگاه صنعتی امیرکبیر, موسسه پژوهشی داده پردازان گیتا**, https://www.civilica.com/Paper-IDMC01-IDMC01_006.html
18. Saulson, Brian, and Kuo Chu Chang. "*Nonlinear estimation comparison for ballistic missile tracking*." Optical engineering 43.6 (2004): 1424-1439.
19. Redman, Brian C., et al. "*Anti-ship missile tracking with a chirped amplitude modulation ladar*." Laser Systems Technology II. Vol. 5413. International Society for Optics and Photonics, 2004.
20. Wells, Lawrence L. "*Real-Time Missile Tracking with GPS*." Navigation 28.3 (1981): 224-230.
21. Lowe, David G. "Object recognition from local scale-invariant features." Computer vision, 1999. The proceedings of the seventh IEEE international conference on. Vol. 2. Ieee, 1999.
22. Ojansivu, Ville, and Janne Heikkilä. "*Blur insensitive texture classification using local phase quantization*." International conference on image and signal processing. Springer, Berlin, Heidelberg, 2008.
23. DC. He and L. Wang (1990), "*Texture Unit, Texture Spectrum, And Texture Analysis*", Geoscience and Remote Sensing, IEEE Transactions on, vol. 28, pp. 509 - 512.

24. Altman, Naomi S. "*An introduction to kernel and nearest-neighbor nonparametric regression*." The American Statistician 46.3 (1992): 175-185.
25. Cortes, Corinna, and Vladimir Vapnik. "*Support-vector networks*." Machine learning 20.3 (1995): 273-297.
26. Viola, Paul, and Michael Jones. "*Rapid object detection using a boosted cascade of simple features*." Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on. Vol. 1. IEEE, 2001.
27. Funayama, Ryuji, et al. "*Robust interest point detector and descriptor*." U.S. Patent No. 8,165,401. 24 Apr. 2012.
28. Binmore, Ken, and Joan Davies. *Calculus: concepts and methods*. Cambridge University Press, 2002.
29. Bracewell, Ronald Newbold, and Ronald N. Bracewell. *The Fourier transform and its applications*. Vol. 31999. New York: McGraw-Hill, 1986.
30. Akbar, Shahid, et al. "*Face recognition using hybrid feature space in conjunction with support vector machine*." J. Appl. Environ. Biol. Sci 5.7 (2015): 28-36.
31. Chang-Yeon, Jo. "*Face Detection using LBP features*." Final Project Report 77 (2008).
32. Zarchan, Paul. *Progress in astronautics and aeronautics: fundamentals of Kalman filtering: a practical approach*. Vol. 208. Aiaa, 2005.

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