ISSN:2348-2079

Volume-7 Issue-1

International Journal of Intellectual Advancements and Research in Engineering Computations

Counting of cement bags in loaded truck

T. Prem Kumar[1], S. Dhinesh[1], R. Guna[1], G. Meiyarasan[2]

[1]UG Scholar, Department of Electrical and Electronics Engineering, Muthayammal Engineering College, Rasipuram

[2]Assistant Professor, Department of Electrical and Electronics Engineering, Muthayammal Engineering College, Rasipuram

ABSTRACT

In this paper we propose a method to count the cement bags moving on a conveyer belt using a video feed from a still camera. This paper is done overcome the drawbacks of the already existing technology using proximity sensor or known as bag counter. We are using the ultrasonic estimation technique to count the bags.

INTRODUCTION

This ultrasonic estimation uses Lucas-Kanade estimation technique to track the cement bags. This technique has been used before in tracking cars.

Video processing and image processing block set blocks are used by this demo to illustrate how to detect and track cars in a video sequence using optical flow estimation.

The model uses an optical flow estimation technique to estimate the motion vectors in each frame of the video sequence. Bythresholding the image and performing morphological closing on vectors, the model produces binary images. It locates the moving cars in each binary image by using blob analysis block followed by draw shapes block to draw a red rectangle around the cars that pass beneath the white line. The counter in the upper left corner gives the count of the number of cars passed in the region of interest.

In tracking cement bags, it required some modification in the demo. In tracking cars there was no background movement but in cement industry, the conveyer belt is moving as well as the cement bags so we used the video processing block Extract ROI to reduce the region of interest. Using this we can concentrate on passing of cement bag through the modified frame.

This technology is purely software based which requires very little hardware components which makes it more accurate and reliable.

PACKING PLANT

The cement is stored in silos before being delivered in bulk using tanker trucks or packaged into 50kg bags and loaded on wagons and trucks. Various means of transport may be used according to the local infrastructure and topography.

Rotary packer has been used in packing plant to fill in cement in the bags.

Conveyer belts are used to carry cement bags and load them in trucks or wagon.

METHOD USED TO COUNT BAGS

Bag counter

This micro-controller based count receives input signal from pulse generating unit incorporating a state of the art proximity sensor, specially developed for dusty environment, and indicates the "Target" value as well as "Production" value. The pulse generating unit

Author for correspondence:
Department of Electronics and Instrumentation Engineering, Nandha Engineering College, Autonomous, Erode.

structure is purely mechanical type containing a mechanical arm, which enables the system to run successfully in dusty environment. Whenever cement bag passes through the mechanical arm and sensor assembly, it touches the moving mechanical arm which due to force by cement bag gets lifted up, the flag fixed on the mechanical arm comes in front of the sensor. The sensor senses flag and produces a pulse. Special sensor is used having protection grade of IP 67, which is immune to dust, immune to oil and immune to water. It is provided with hooks for hanging at the 4 to 6 meter height. Extra large size, bright red display is suitable for viewing from distance. The output contact are used as an interlocking circuit for generating an alarm and it can also be used to stop feeding of the bag to the truck or wagon.

This bag counter includes:

- Pulse Generating Unit
- Bag Display Unit

It consists of mechanical assembly and specially developed proximity sensor. The pulse generating assembly is to be installed on telescopic conveyor. The signal from the pulse generating unit is fed to the counter unit.

Other sensors like photoelectric sensor, inductive or capacitive sensors can also be used as per the site conditions and requirement.

This is a micro Controller based fully programmable user friendly unit which makes it more efficient. Micro controller based circuitry with proven circuit makes it the most wanted bag counter in industry.

The counter is having two display:

- Target
- Production

The value indicated by display "Target" shows the set value. The value indicated by "Production" means the achieved value.

Control Unit

Parameters of display unit: Parameters like changing the target value and resetting the counter can be set by control unit. It is a handy unit of compact size generally kept hanging with the help of cable can also be provided with connector so that the chief loader can have only one control unit common for all counters.

Logic of Operation with Enable And Start

With supply on "ON" solenoids are "OFF". When enable contact gets closed means the pulse is generated. cycle starts. Start contact may be momentary or permanent. If start contact is momentary when enable contact is open cycle. stops. If start contact is permanent, it opens either enable or start contact to stop the cycle.

Drawbacks of bag counting unit

- If two bags approaches the mechanical arm without any gap between them then the bag counter counts them as one.
- Since the pulse generating unit consists of a moving arm, when the bag is passed it rebound sometimes to give it an extra count.
- The labors in the packing plant involves in malpractices by stealing the bags and they do so by holding the mechanical arm when one bag passes and let the other bag pass without counting it. This is the major issue in the cement industry and they are suffering heavy loss in terms of capital.

VIDEO PROCESSING

In electronics engineering, video processing is a just an another case of signal processing, which regularly employs video filters and it is used where the input signals and output signals are video streams and video files. This technique is used in video players, video codec, television sets and other devices.

LUCAS-KANADE ESTIMATION METHOD

The original image alignment algorithm was the Lucas-Kanade algorithm. The main aim of LucasKanade is to align a template image T(x) to an input image I(x), where x= (x,y)T is a column vector containing the pixel coordinate. If the Lucas-Kanade algorithm is being used to compute optical flow or to track an image patch from short time interval , the template T(x) is an extracted sub-region(a 5X5 window, maybe) of the image at T=1 and I(x) is the image at T=2.

Let W(x:p) denote the parameterized set of allowed warps, where p = (p1,p2,….pn)T is a vector of set of parameters. W(x:p) takes the pixel x in the coordinate frame of the template T and maps it to the sub-pixel location W(x:p) in the coordinate frame of the image I. If we are computing optical flow, the warps W(x:p) might be the translation:

where the vector of parameters p = (p1,p2)T is then the optical flow. If we are tracking a larger image patch moving in 3D we may instead consider the set of affine warps:

$$W(x:p) = \begin{pmatrix} (1+p_1).x+p_3.y+p_5 \\ p_2.x+(1+p_4).y+p_6 \end{pmatrix} = \begin{pmatrix} 1+p_1 & p_3 & p_5 \\ p_2 & 1+p_4 & p_6 \end{pmatrix} \begin{pmatrix} x \\ y \\ 1 \end{pmatrix}$$

Where there are 6 parameters p=(p1,p2,p3,p4,p5,p6)T as, for example, was done in [9]. (There are other ways to give parameters affine warps. Later we will investigate what is the best way.) Generally, the number of parameters n may be randomly large and W(x:p) can be randomly complex.

One example of a complex warp is the set of piecewise affine warps used in Active Appearance Models and Active blobs .

This method assumes that the displacement of the content of the image between two nearby frames is relatively small and almost constant within a neighbourhood point s under consideration. Thus the optical flow equation assumed to hold all pixels within centered window at s. Namely, the local image velocity vector (Vx,Vy) must satisfy, Ia(q1)Va + Ib(q1)Vb = -It(q1) (2)

Ia(q2)Va + Ib(q2)Vb = -It(q2) (3)

Ia(qn)Va + Ib(qn)Vb = -It(qn) (4)

Where q1,q2,….qn are the pixels inside the window, and Ia(qi), Ib(qi), It(qi) are the partial derivatives of the image I with respect to positions a, b and time t, evaluated at the point qi and at the current time. These equations can be written in matrix form A v=b, where

$$A = \begin{pmatrix} I_x(q_1) & I_y(q_1) \\ I_x(q_2) & I_y(q_2) \\ \vdots & \vdots \\ I_x(q_n) & I_y(q_n) \end{pmatrix}, \quad v = \begin{pmatrix} V_x \\ V_y \end{pmatrix} \text{ and } b = \begin{pmatrix} -I_t(q_1) \\ -I_t(q_2) \\ \vdots \\ -I_t(q_n) \end{pmatrix}$$

This system contains more equations than unknown which results in over-determined. This method obtains a solution by least square principle. It solves a 2x2 system, AT Av = AT b v= (AT A)-1 AT b

Where AT is the transpose matrix of A. That is, it computes,

$$\begin{pmatrix} V_x \\ V_y \end{pmatrix} = \begin{pmatrix} \sum_i I_x(q_i)^2 & \sum_i I_x(q_i)I_y(q_i) \\ \sum_i I_y(q_i)I_x(q_i) & \sum_i I_y(q_i)^2 \end{pmatrix}^{-1} \begin{pmatrix} -\sum_i I_x(q_i)I_t(q_i) \\ -\sum_i I_y(q_i)I_t(q_i) \end{pmatrix}$$

ATA is often known as structure tensor of the image at the point p.

Prem K T et al., Inter. J. Int. Adv. & Res. In Engg. Comp., Vol.–07(01) 2019 [1033-1038]

COUNTING OF CEMENT BBAGS USING

Lucas-kanade technique

Here we use MATLAB simulink blocks and LucasKanade Estimation technique to count the cement bags on a moving conveyer belt. There are six different blocks from getting the input to displaying the result in terms of counts. Here fig3 displays the

First Block: video input

On windows, reads video frames and/or audio samples from a compressed or uncompressed multimedia file. Multimedia files can contain audio, video, or audio and video data. On non-windows platforms, reads video frames and/or audio samples from an uncompressed AVI file. Number of times to play file can be given and maximum is infinite. Multimedia output can be in form of video and audio or audio or video only. Image color space can be in RGB or Intensity. Image signal can be one multidimensional signal or separate color signal.

Second Block: Extract ROI

Select or reorder specified elements of a multidimensional input signal. The index to each element is recognized from an input port or this dialog. We can choose the indexing method for each dimension with the use of "Index Option" parameters. Using this block we can minimize the region of interest for further processing of the video.

R'G'B to Intensity

It converts color information between color spaces which are red, green and blue. Use the conversion parameters to specify the color spaces you are converting between. There are various choices from which we can select the desired one. All conversions support double-precision floating point and single-precision floating-point inputs.

Fourth Block: Optical Flow (Lucas-Kanade)

Estimates optical flow across two or more video frames.

The gradient filter used here is derivative of gaussian. Different parameters are available which can be altered according to the requirement. Parameters like standard deviation for image smoothing filter and gradient smoothing filter. Threshold for noise reduction can also be decreased or increased according to the noise present in the video

bag counting model.

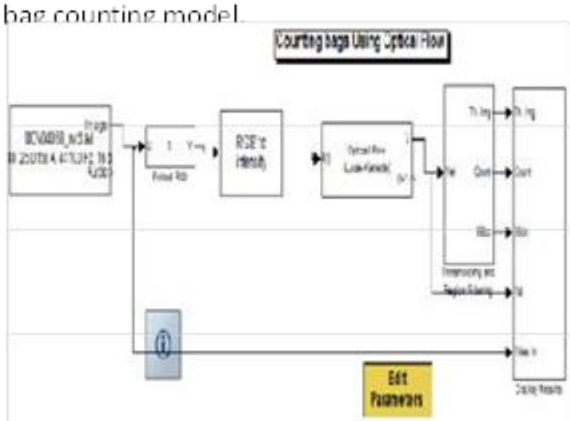
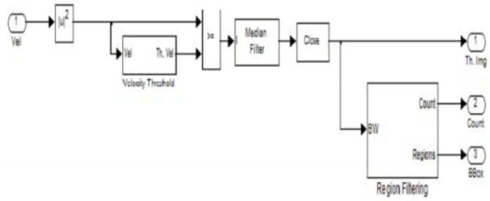


Fig3. Bag Counting Model

E. Fifth Block: ThresholdingAnd Region Filtering

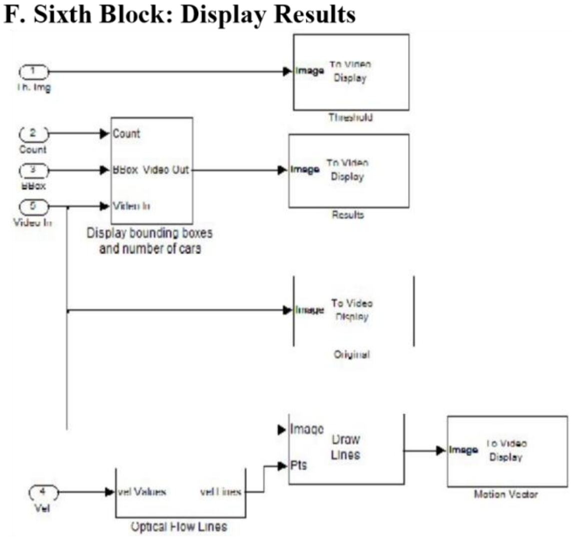


This block filters the cement bag from the rest of the

Video and count the bag using blob analysis which uses the bounding box technique which creates a box around the bag and count it.

It uses median filter for filtering which uses neighbourhood size parameters to specify the size of the neighbourhood over which the block computes the median. It uses the output size parameters to specify the dimensions of the output. well as the motion vector and the threshold

F. Sixth Block: Display Results



This block displays the counted bags on the video as

.

RESULTS AND DISCUSSION

In this paper, we applied the optical flow estimation technique to count the cement bags passing on the conveyer belt to overcome the drawbacks of the already existing technique known as bag counter. We proposed a simple method for counting cement bags. Through experimental evaluation using actual video sequences, we displayed the count of actual bags passed.

FUTURE WORKS

As future works, this technique can be used by any product based industry to count the products where these malpractices takes place with the slight modification in the parameters.

This can be an important part of the automation in future.

REFERENCE

[1]. B.D. Lucas and T. Kanade, "An Iterative Image Registration Technique with an Application to Stereo Vision," Proc. Seventh Int'l Joint Conf. Artificial Intelligence, 81, 1981 ,674-679.

[2]. S. Benhimane and E. Malis, “Real-Time Image-Based Tracking of Planes Using Efficient Second-Order Minimization,” Proc. Int'l Conf. Intelligent Robots and Systems,. 5, 2004.

[3]. K.K. Sung and T. Poggio, "Example-Based Learning for View-Based Human Face Detection," IEEE Trans. Pattern Analysis and Machine Intelligence, 20(1), 1998, 39-51.

[4]. O. Javed, S. Ali, and M. Shah, "Online Detection and Classification of Moving Objects Using Progressively Improving Detectors," Proc. IEEE CS Conf. Computer Vision and Pattern Recognition, 2005.

[5]. B.K.P. Horn and B.G. Schunck, "Determining Optical Flow," Artificial Intelligence, 17(1-3), 1981, 185-203

[6]. Philip A Alsop, Hung Chen and Herman Tseng,"The Cement Operation Handbook",Fifth Edition.

[7]. S. Sclaroff and J. Isidoro. Active blobs. In proceedings of the 6th IEEE International Conference on Computer Vision,pages ,1998, 1146-1153.

[8]. Simon Baker and Iain Matthews. Lucas-Kanade 20 years on: A Unifying Framework:Part 1. The Quantity Approximated, The Warp Update Rule,and The Gradient Descent Approximation,Carnegie Mellon University Robotics Institute,2002.

[9]. J.R. Bergen, P. Anandan, K.J. Hanna, and R. Hingorani. Hierarchical model-based motion estimation. In Proceedings of the European Conference on Computer Vision, 1992, 237–252.

[10]. S. Sclaroff and J. Isidoro. Active blobs. In Proceedings of the 6th IEEE International Conference on Computer Vision, 1998, 1146–1153.