

# Accurate People Counting with Monoscopic Vision Technology and Embedded Software – What You Need to Know!



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## INTRODUCTION

The retail industry is becoming increasingly more aware of the importance of monitoring the number of visitors or so called foot traffic or footfall to their establishments. After sales data, many retailers consider foot traffic as the most important key indicator of a store's performance, providing key performance indicators such as sales conversion and average basket size. The sales conversion rate is simply total sales transactions divided by total foot traffic, most often expressed as a percentage. The trend for improved insights to patronage can also be seen at other locations such as, exhibition buildings, sports and gym facilities, and public institutions such as libraries, universities, and hospitals. In the transportation sector, there is also an increasing demand for monitoring the number of passengers entering trains, trams, busses, etc.

## SEVERAL WAYS TO CAPTURE FOOT TRAFFIC

To capture footfall and calculate sales conversion, a traffic counting system is necessary. Today, there is a variety of equipment for counting people available to retailers, ranging from low-end infrared beams to high-end sensors based on camera or radar technology. While the low-end infrared beams offer a low cost solution, the accuracy is often poorer creating a distrust in the reliability of the foot traffic. High-end counting sensors on the other hand, offer far better data accuracy and will provide reliable and useful data over time, but at a cost of course. Furthermore, high-end solutions often come with tools for easy deployment, maintenance, and data collection.

## PEOPLE COUNTING WITH MONOSCOPIC VISION TECHNOLOGY

One particular high-end solution for capturing foot traffic that has found wide spread acceptance is based on running advanced video analytics algorithms directly embedded on standard monoscopic network cameras. This is the kind of camera retailers are most likely to deploy in their stores for loss prevention purposes. The solution offers a setup where standard off-the-shelf cameras can be used for high accuracy people counting, giving retailers the opportunity to use the same type of equipment and infrastructure for foot traffic capturing as well as for surveillance.

A monoscopic camera is characterized by having just one lens as opposed to stereoscopic cameras that have two. Using a monoscopic camera for people counting puts high demands on the algorithms being used. In the past, such algorithms have been sensitive to shadows, sun light, etc., but over the years they have become increasingly better and more robust. Paired with increased processor capacity in modern cameras, leading algorithms for monoscopic cameras today offer an accuracy that can easily compete with solutions based on more specialized and more expen-

sive hardware like stereo cameras. Leading algorithms are today able to deselect children, adopt the counting zone to various types of entrances (e.g. revolving doors, escalators, and elevators) as well as count across large entrances by pairing cameras.

## ... AND EMBEDDED SOFTWARE

Just as there are several methods to do people counting, there are also numerous ways of working with camera based counting. Some solutions require the support of servers at the location, where as embedded technology is just that - 100% embedded in the camera requiring no other hardware than the camera itself. Obviously, this has several advantages besides being cost effective. At the retail location, there is less equipment that takes up space, needs to be maintained, and supported. Potential privacy and security issues with camera based people counting can be overcome with some providers having the possibility of blurring the live video stream and not storing anything besides the numeric count.

## ACCURACY

A pivotal characteristic of a people counting sensor/camera is the accuracy. The accuracy can be measured in different ways. A simple measure is to compare the total number of people entering and exiting a facility over a day. The deviation between entering (IN) and exiting (OUT) is calculated to get an accuracy value each day of the month. A common formula is given by:

$$(IN-OUT)/(IN+OUT) \times 200$$

which gives the error percentage (%).

Another method is to manually count the foot traffic and compare to automatic count from the sensor. For this scenario, we should be aware of the fact that neither manual nor automatic counting is a 100% accurate, since a person will miss counting correctly particularly in dense counting scenarios with many people entering and leaving at the same time. The recommended way of assessing the accuracy through manual counting is the following:

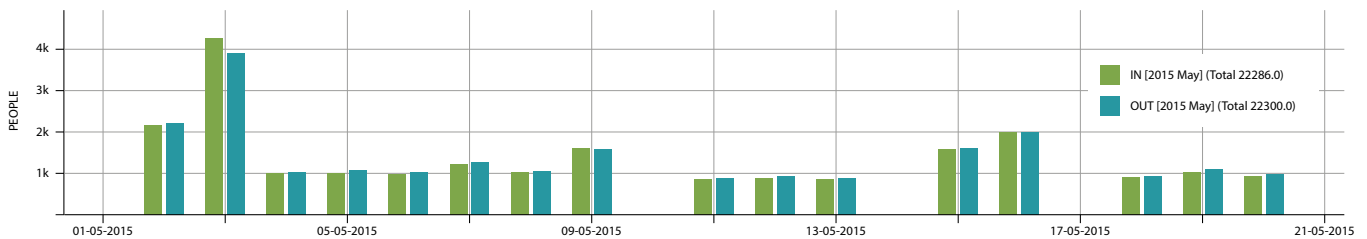
Start by measuring accuracy for people going in only. Make a note of the total count on the counting unit and immediately start counting people manually until reaching 200 people going in. Immediately note the total count on the counting unit and compute the difference which will be #IN. The error percentage is given by the formula:

$$(\#IN - 200)/2$$

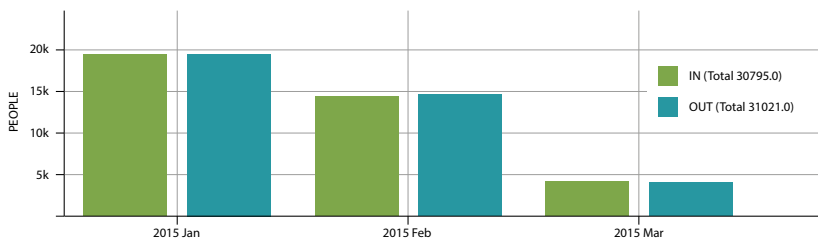
Then repeat the same procedure but for people going out.

We recommend the latter method for measuring the accuracy, but it will of course require more manual work. In any case, a monoscopic camera running leading algorithms for people counting should under normal conditions produce a flow accuracy of 95 % and often as high as 99 % over time. Cameras are mounted overhead at entrances and easy to install. Counting systems can be in-store, over local network, or fully web-enabled at once to suit the client.

*SOME RECENT EXAMPLES FROM INSTALLATIONS IN GERMANY SHOW LARGE QUANTITIES OF PEOPLE (20.000-30.000) ENTERING AND EXITING OVER PERIODS OF THREE WEEKS AND THREE MONTHS WITH AN ACCURACY OF 99+ % OR AN ERROR RATE OF < 1 %.*



Location: Large furniture store in Germany. Entrance in strong sunlight producing shadow effects.  
Accuracy = 99,9%



Location: Electronic store in Berlin, two entrances, one to street with strong sunlight and shadows, the other to a mall.  
Accuracy = 99,3%



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If you are a system integrator interested in reselling our applications, please e-mail [sales@cognimatics.com](mailto:sales@cognimatics.com) to be connected with the representative for your region.

**ABOUT COGNIMATICS:**

Cognimatics has a long and strong track record in people and customer counting and also other applications for queue management and occupancy for retail and other locations including related reporting to make the most of the intelligence captured.

The applications are 100% embedded in standard network cameras, requiring no additional hardware.

Via a global distributor and system integrator network, the company had sales to more than 70 countries last year. Many of the most successful retail chains in the world use Cognimatics' products to improve their performance and enhance the customer experience.

Founded in 2003, Cognimatics is a Swedish company, with a team of world leading researchers from the field of Video Analytics. Cognimatics technology rests on a sound scientific foundation and is often praised for its accuracy. For more information about Cognimatics and how our solutions can work for you, please visit our website where you will find several case studies: [www.cognimatics.com](http://www.cognimatics.com)