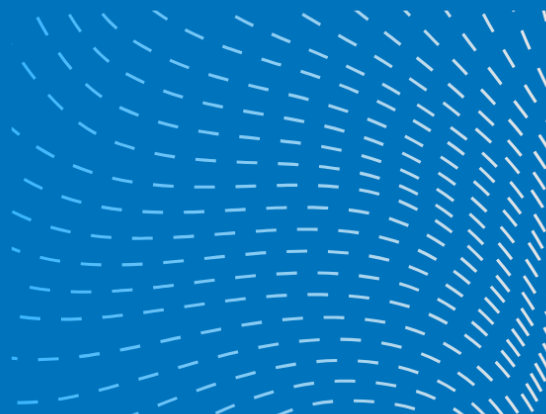


IPXAnalytics
Datasheet

Industrial Module



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IPExtreme

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Industrial Module

Compatibility: IPXAnalytics STANDARD, 2.0 or higher.

IPXAnalytics

IPXAnalytics is a software that utilizes artificial intelligence to learn and detect events from surveillance cameras. The artificial intelligence is based on neural networks and LLMs, which are algorithms designed to mimic human brain behavior. Compared to existing video analysis software on the market today, IPXAnalytics significantly reduces the number of false alarms.

Standard Module for Industries

Our industrial module offers a range of advanced features to ensure safety, efficiency, and compliance in industrial environments. Key highlights include:

Person Detection in Hazardous Areas: Our system utilizes algorithms to identify and monitor risk zones, ensuring worker safety in dangerous environments.

PPE Usage Verification: Through real-time video analysis, we can identify whether employees are using proper Personal Protective Equipment (PPE), ensuring compliance with safety regulations.

Machine and Production Status Monitoring: We integrate sensors and monitoring systems to provide real-time information on machine status and production efficiency, enabling quick responses to failures and process optimization.

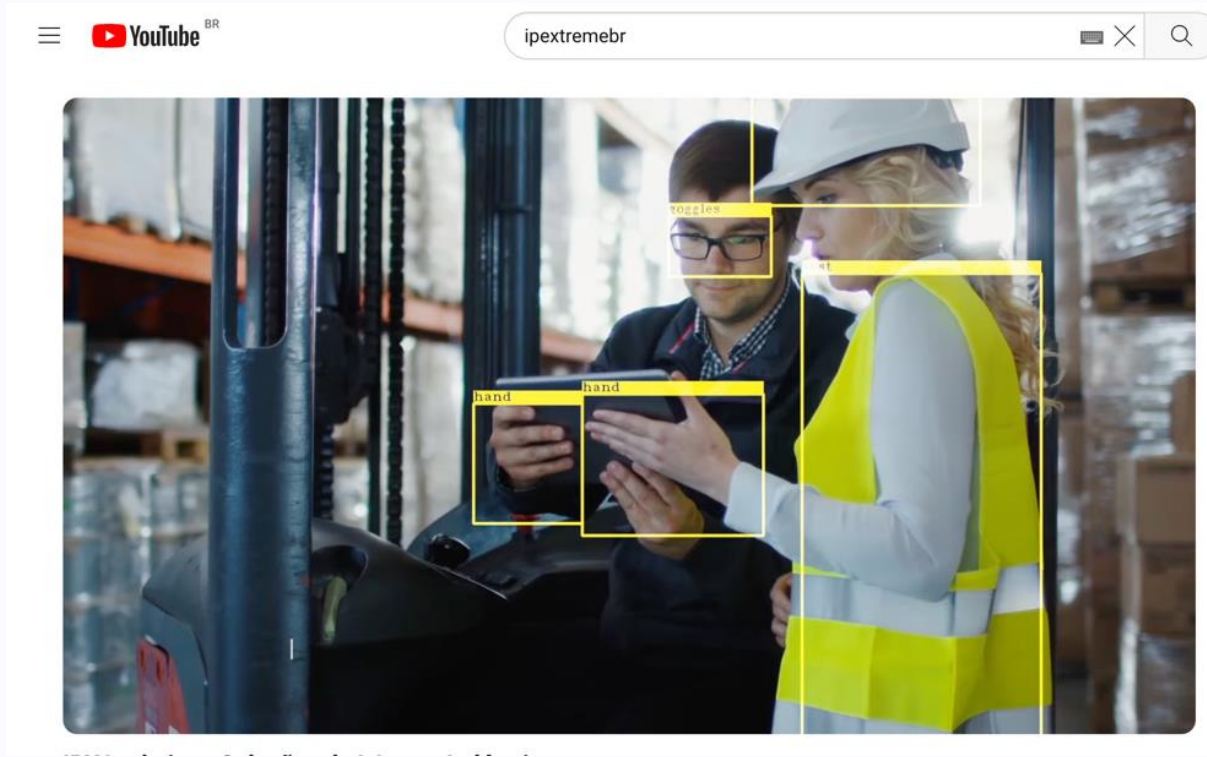
Proximity Detection with Moving Machinery: Our technology can detect the proximity of individuals to moving machinery, reducing the risk of accidents and increasing safety on the factory floor.

Customization for Specific Needs: We offer the flexibility to tailor our software to meet the specific needs of each client, whether for detecting unique situations, integrating with existing systems, or adapting to particular industrial environments.

Additional Benefits:

- Enhanced workplace safety.
- Reduction in accidents and incidents.
- Improved operational efficiency.
- Compliance with safety regulations.
- Flexibility and scalability to adapt to various industrial environments.

Commercial Video



<https://www.youtube.com/watch?v=VJ90HsXwUJQ>

Feature Examples

Detection of People in Hazardous Areas

The software can detect people in restricted zones or areas where machinery is in operation. By using IPXMonitor or a VMS, we can configure the logic to trigger alarms only in specific situations.

Another example would be the software detecting a hazardous scenario, such as a container filled with molten steel or fire, and activating person detection.



PPE Detection

The software can detect PPE such as helmets, goggles, masks, ear without earmuffs, vests, and boots to alert if a worker is not complying with safety regulations.

Examples of Operation:

<https://www.youtube.com/watch?v=COJQGWkBhS8>

<https://www.youtube.com/watch?v=EtndwNc5qxY>

<https://www.youtube.com/watch?v=EtndwNc5qxY>

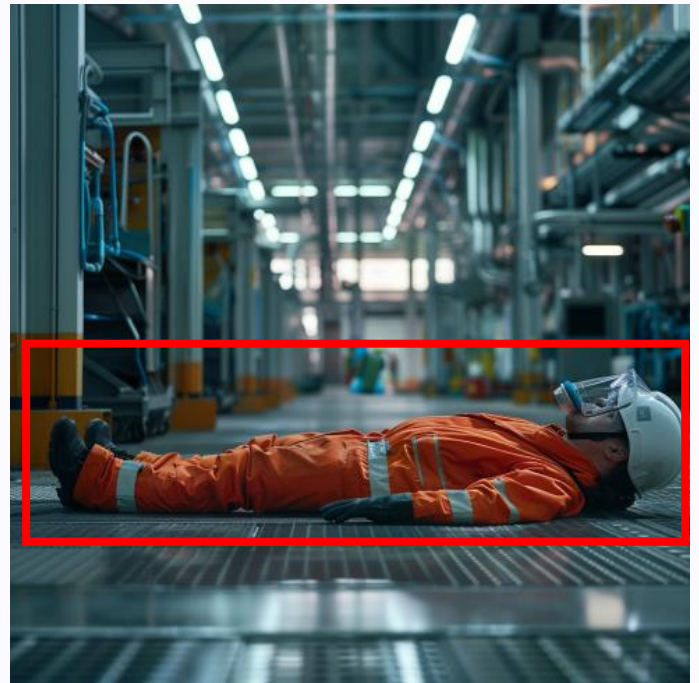


Fall Detection

The software can detect people who have fallen on the ground. In critical areas where people might have accidents or even faint, the software can detect falls and provide real-time alerts.

Example:

https://www.youtube.com/watch?v=5ZiUTN385_I



People and Forklift Detection

The software can detect machines such as forklifts and issue alerts if a person is in the same zone as the forklift or too close to it.



Integration

The software features an HTTP REST API that enables integration with any partner system. It is also integrated with the leading VM5s in the market: Digifort, D-Guard, Milestone, and Avigilon.

Please check with our team about any additional licenses required for third-party software integrations.

For more information:

www.ipextreme.com.br



Customizations

In addition to the various functionalities mentioned here, the software can also assist in numerous other situations. It is designed to be customized to meet the client's needs. For example, in a production environment, the software could identify errors and critical failures in a specific part. To request a customization proposal, please contact us on our website: www.ipextreme.com.br.

Limitations and Considerations

We understand the importance of reliability in critical applications. Therefore, it is crucial to note that no artificial intelligence software can guarantee 100% accuracy. Our solution offers robust and rapid detection, but we always recommend maintaining backup systems and additional security protocols to ensure a comprehensive response in emergency situations.

IPXAnalytics offers demonstration licenses, and we recommend selling to the client only after successful tests in the desired environment.

Datasheet

Objects samples and descriptions:

Objects

The Module for Industries can identify these objects:

- person
- face_frontal
- goggles
- ear
- ear_protector
- nose
- mask
- hand
- forklift
- boot
- not_boot
- cone
- ladder
- fall
- cellphone
- head
- orange_vest

- blue_vest
- yellow_vest
- gray_vest
- striped_vest
- red_helmet
- yellow_helmet
- blue_helmet
- gray_helmet
- green_helmet
- white_helmet
- black_helmet

person

The person object is the main object that allows the software to perform various other detections. To detect a person, the software will look for legs, arms, and a head. It is also possible to detect people close to the camera even if only the upper half of their body is present.



face_frontal

The software is able to detect faces when they are clearly facing the camera (frontal face), which is essential for correctly identifying facial objects such as masks and glasses. Frontal face detection ensures that the face is visible and positioned appropriately, allowing for accurate analysis of the elements present.



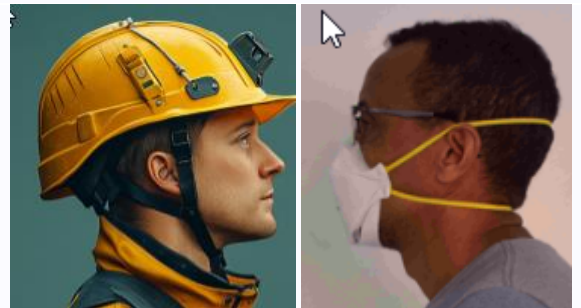
goggles

The models of glasses that can be detected are illustrated on the right. Since this is a small object, it is essential that the camera is positioned with a good level of zoom focused on people's faces.



ear

One of the features requested by clients is detecting whether an employee is wearing earmuff-style hearing protection. Instead of detecting the protector itself, we recommend detecting the visible ear, as this will be much more effective. Ears are better detected when the face is in a side profile position. To understand the ideal size of the object in the image for detection, refer to the final chapter of this document.



ear_protector

As mentioned in the previous section, detecting the absence of earmuff-style hearing protection is a requirement for many clients. Although the IPX detects the protector as shown in the images on the right, the ideal approach is to generate the alert using the ear object. If you wish to test directly with the ear_protector object, use the **contains** rule with the person object as the primary reference.



nose

One of the features requested by clients is detecting whether an employee is wearing a mask. Instead of detecting the mask itself, we recommend detecting the visible nose, as this will be much more effective. The nose is best detected when the face is in a frontal position. Therefore, use the **contains** rule with the primary object being frontal_face + nose. To understand the ideal size of the object in the image for detection, refer to the final chapter of this document.



mask

As mentioned in the previous section, detecting the absence of a mask is a requirement for many clients. Although the IPX detects the mask as shown in the images on the right, the ideal approach is to generate the alert using the nose object. If you wish to test directly with the mask object, use the **contains** rule with the `frontal_face` object as the primary reference.



hand

Hand detection is required in various projects to identify objects in potentially hazardous situations or to check if a person is wearing gloves. When we talk about gloves, we are referring to detecting hands with a specific color. We recommend that clients use brightly colored gloves, such as yellow, blue, or green.



forklift

The forklift models that can be detected are shown on the right. It is possible for the IPX to detect similar objects; however, we recommend that the client test it before purchasing to ensure the software meets their expectations.



boot

One of the industry's requirements is to detect whether a person is wearing safety boots. IPX can detect black boots, as shown in the image on the right, but it's important to note that the software can't definitively determine whether they're safety boots. The main idea is for the software to identify footwear styles that are significantly different from boots, such as sneakers.



not_boot

The "non-Boot" object will detect any type of footwear that is very different from the boot object mentioned in the previous section. Some examples are shown on the right. It is recommended that the client test it to ensure that the software meets their expectations. To understand the ideal size of the object in the image for detection, refer to the final chapter of this document.



cone

The cone object is present in various construction sites and industries and can be detected as shown in the images on the side. The cones should be completely orange or orange with white stripes.



ladder

Ladders are present on construction sites and in industries and sometimes need to be detected as an activity alert on the site. There are various types of ladders, but the IPX has been trained to detect ladders like the one shown in the image on the side. It is possible that the IPX can detect similar objects, but we recommend that the client test it before purchasing to ensure the software meets their expectations.



fall

Fall detection is a highly requested feature from customers, such as those in industries. It's possible that IPX can detect falls from different angles, but we recommend testing it before purchasing to ensure the software meets their expectations.



cellphone

Cell phone detection is very useful in industrial environments. Because a cell phone is a small object, the camera needs to be of good quality and well-positioned. To understand the size of objects, see the final chapter of this document. We recommend that customers test before purchasing to ensure the software meets their expectations.



head

The head object is detected by the IPX when the person is not wearing a helmet. Therefore, if the client wants to detect a person who is not wearing a helmet, they should use the **contains** rule with the primary object being person + head.



orange_vest

Safety vests are widely used and essential in industries. We first need to define a safety vest as one that contains reflective stripes. Based on this concept, the IPX has been trained to detect some models. On the right are some models in orange. It is possible that the IPX can detect similar objects, but we recommend that the client test it before purchasing to ensure the software meets their expectations.



blue_vest

Safety vests are widely used and essential in industries. We first need to define a safety vest as one that contains reflective stripes. Based on this concept, the IPX has been trained to detect some models. On the right are some models in blue. It is possible that the IPX can detect similar objects, but we recommend that the client test it before purchasing to ensure the software meets their expectations.



yellow_vest

Safety vests are widely used and essential in industries. We first need to define a safety vest as one that contains reflective stripes. Based on this concept, the IPX has been trained to detect some models. On the right are some models in yellow. It is possible that the IPX can detect similar objects, but we recommend that the client test it before purchasing to ensure the software meets their expectations.



gray_vest

Safety vests are widely used and essential in industries. We first need to define a safety vest as one that contains reflective stripes. Based on this concept, the IPX has been trained to detect some models. On the right are some models in gray. It is possible that the IPX can detect similar objects, but we recommend that the client test it before purchasing to ensure the software meets their expectations.



striped_vest

Safety vests are widely used and essential in industries. We first need to define a safety vest as one that contains reflective stripes. Based on this concept, the IPX has been trained to detect some models. On the right are some multicolored models. It is possible that the IPX can detect similar objects, but we recommend that the client test it before purchasing to ensure the software meets their expectations.



red_helmet

In most cases, the client needs to detect whether the employee is wearing a helmet or not. The following topics will list the detectable helmet models. The following topics will list the detectable helmet models. An example of a red helmet is shown in the image beside.



yellow_helmet

An example of a yellow helmet is shown in the image beside.



blue_helmet

An example of a blue helmet is shown in the image beside..



gray_helmet

An example of a gray helmet is shown in the image beside.



green_helmet

An example of a green helmet is shown in the image beside.



white_helmet

An example of a white helmet is shown in the image beside.



black_helmet

In most cases, the client needs to detect whether the employee is wearing a helmet or not. An example of a black helmet is shown in the image beside. **Note:** Although the IPX can identify the black helmet, depending on the distance, it may be easily confused with hair. We always recommend using helmets in more vibrant colors such as yellow, white, blue, or red.



Minimum Recommended Sizes for Detection

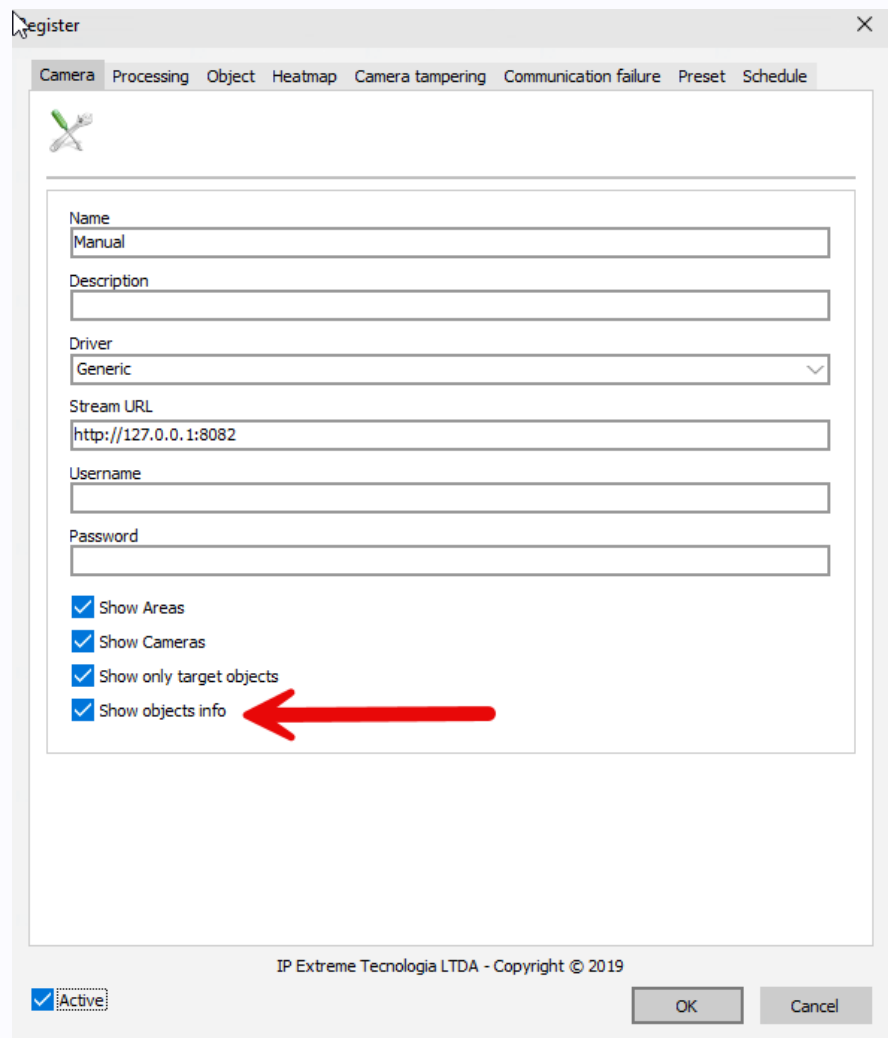
A common question is about the position where the camera should be installed for optimal detection. It is difficult to say with complete certainty because cameras can have different lenses, angles, and zoom levels. The most important factors are the size of the object in the image and its visibility. The table below indicates the minimum recommended object size in the image as a percentage. The percentage refers to the relative size of the object, as there may be various types of resolutions and resizing. So, when we say an object is 1% in size, we are indicating that, for example, in a 512x512 image, the object would be 5.12 pixels by 5.12 pixels. See the next chapter for instructions on how to check the object's size directly in IPXAnalytics.

Object	Minimum percentage size for identification	Camera Height
person	1%	3-10 meters
face_frontal	1%	1-3 meters
goggles	0.5%	1-3 meters
Ear	0.2%	1-3 meters
ear_protector	0.2%	1-3 meters
nose	0.2%	1-3 meters
mask	0.2%	1-3 meters
hand	0.5%	1-3 meters
forklift	1%	1-10 meters
boot	0.5%	1-3 meters
not_boot	0.5%	1-3 meters
cone	0.2%	1-5 meters
Ladder	1%	1-5 meters
fall	1%	1-3 meters
Cellphone	1%	1-3 meters
head	0.2%	1-5 meters
helmet	0.2%	1-5 meters

How to identify an object size

In IPXAnalytics, it is possible to view the live image in two ways: by using Debug mode or by clicking on Preview in the admin client.

When registering a camera, on the first tab, check the option "show objects info." This option will display the size of each detected object in the image and its orientation (vertical or horizontal).



The screenshot shows the 'Register' dialog box with the 'Camera' tab selected. The form contains the following fields and options:

- Name: Manual
- Description: (empty)
- Driver: Generic
- Stream URL: http://127.0.0.1:8082
- Username: (empty)
- Password: (empty)
- Checkboxes:
 - ☒ Show Areas
 - ☒ Show Cameras
 - ☒ Show only target objects
 - ☒ Show objects info (highlighted with a red arrow)

At the bottom, there is an 'Active' checkbox (checked), the copyright notice 'IP Extreme Tecnologia LTDA - Copyright © 2019', and 'OK' and 'Cancel' buttons.

Examples:

A person detected in the image with a total size of 4.0%.

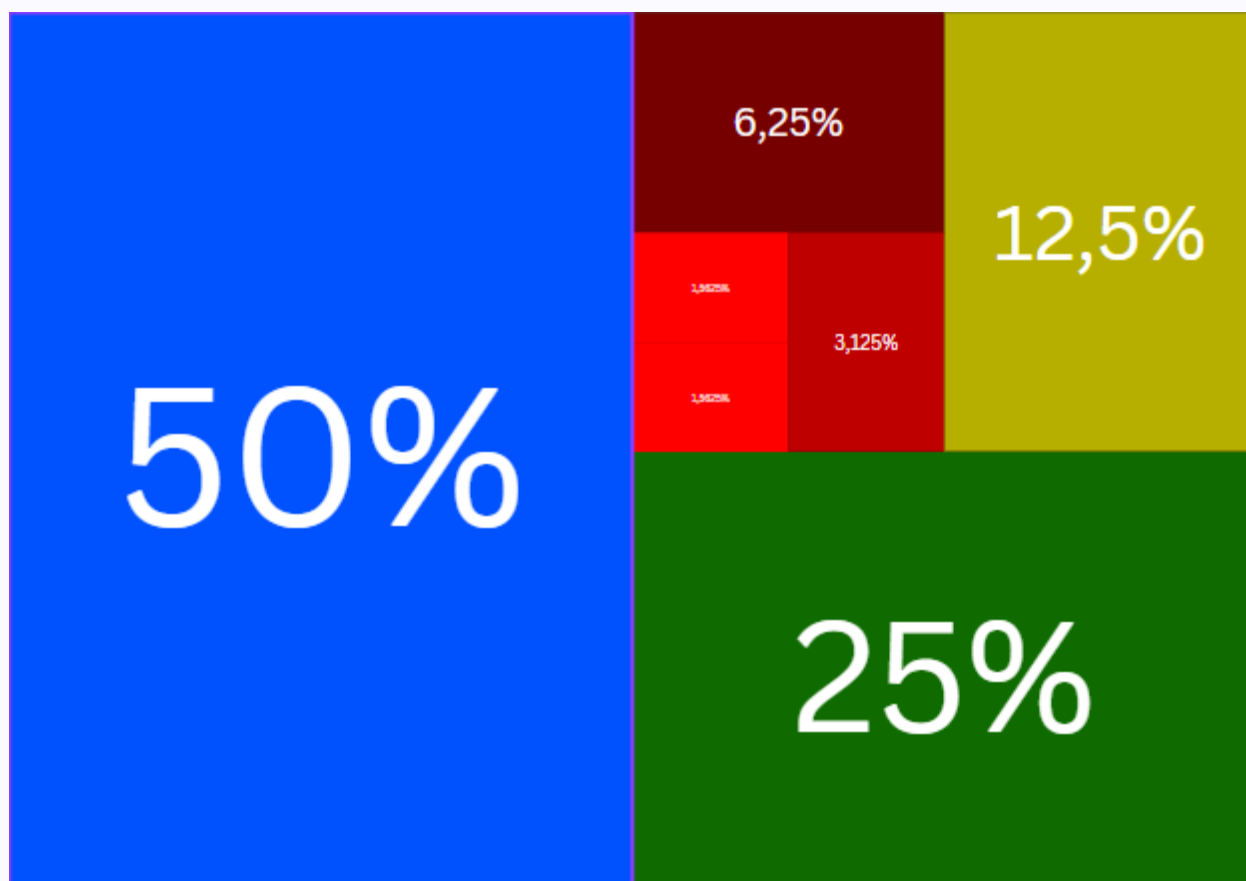


Helmet detected in the image with a size of 0.69%.



The image was created to visually illustrate the proportion of an object in relation to the total screen. It divides the space into different percentage areas, making it easier to understand the minimum size required for computer vision software to accurately recognize an object.

Each rectangle represents a specific fraction of the total screen, starting at 50% and successively subdividing each area into halves. This way, the user can intuitively understand how different sizes impact detection and what minimum dimensions are recommended for effective recognition.



Ideal Camera Resolution for Object Recognition

For effective object recognition, camera resolution is essential. The minimum recommended resolution for optimal performance is **512x512**. This resolution provides enough detail for accurate detection and classification while balancing computational efficiency. Higher resolutions, like 1080p or 4K, require more processing power without significantly improving accuracy, and may lead to diminishing returns. On the other hand, lower resolutions can result in blurred or distorted images, making object recognition difficult. Therefore, 512x512 resolution is the minimum ideal for reliable and efficient object detection.

Low resolution vs High resolution comparison:

