# Top 10 Machine Vision Improvement Opportunities

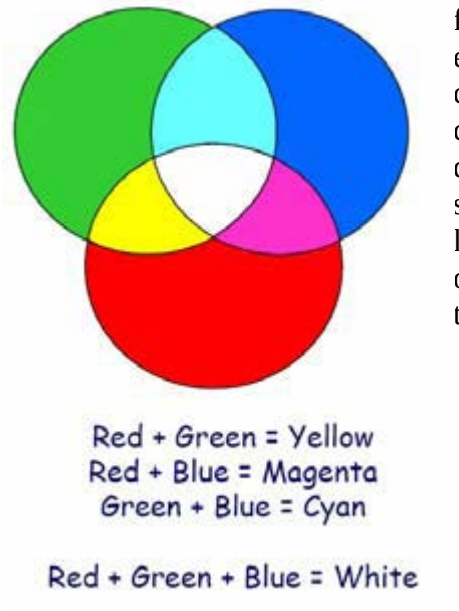
As the global manufacturing market continues to get more competitive, it is important to ensure that your factory is running at a peak level of efficiency. Any downtime due to process related malfunctions is considered non value-added downtime directly impacting company profitability.

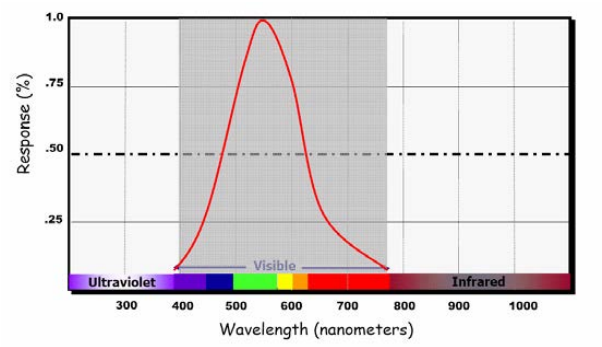
Machine vision is an area that if setup correctly can reduce process inefficiencies. If your facility uses machine vision as robot guidance or inspection, there is always an area of improvement that can be investigated. Listed below are the top ten areas that if not setup correctly, may be causing non value added downtime to your machine vision process.

**Here are the top 10 areas to improve vision system efficiency:**

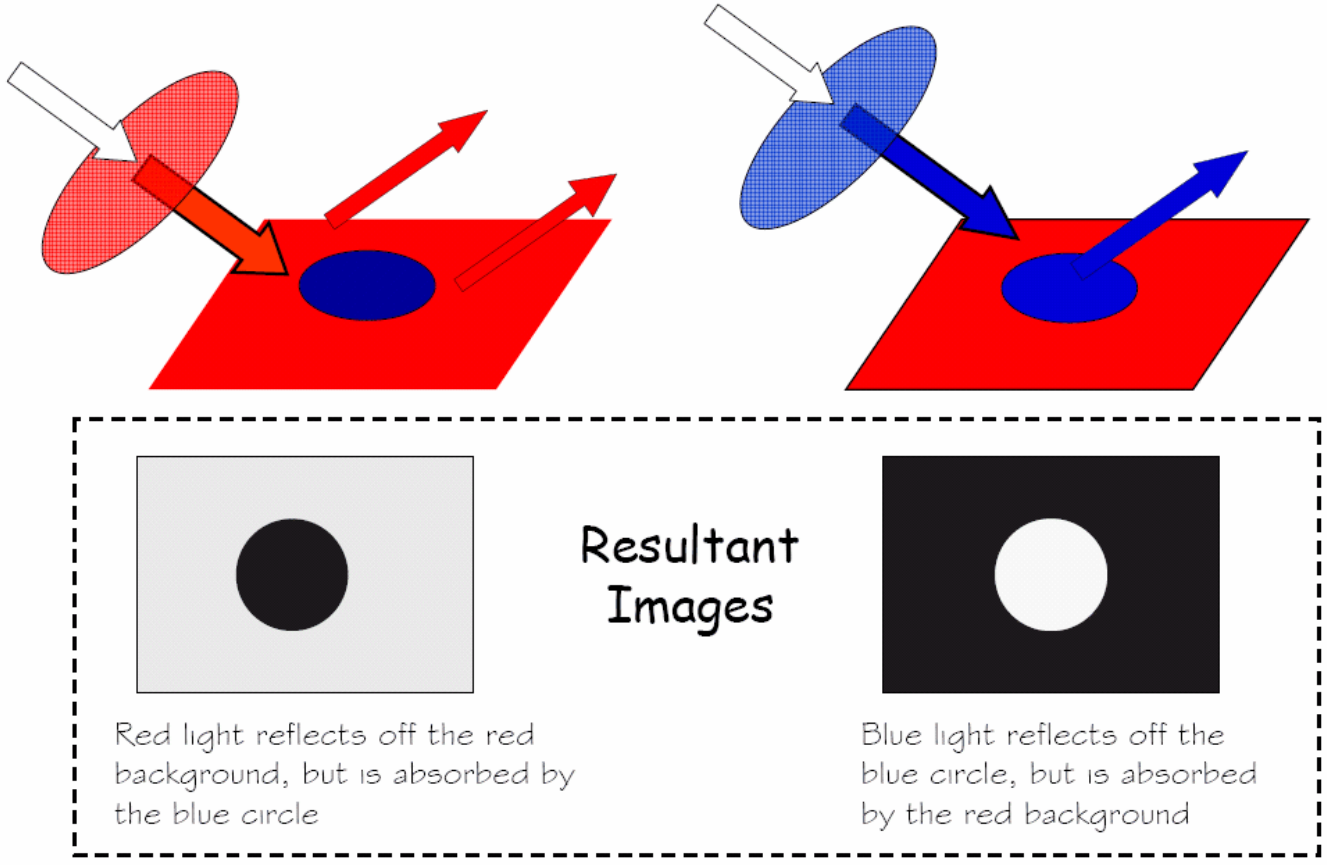
1) **Lighting Technique** - Are you using the correct lighting techniques to illuminate the region of interest? Backlighting, Bright Field Lighting, Grazing, Low Angle Linear Array, Dark Field, just to name a few are lighting techniques which are the most critical aspect of machine vision robustness. Depending on the part surface finish and contour, the correct lighting technique will enhance flaws or remove image noise which will increase the efficiency and stability of your system. The intention is to select a lighting technique that will produce the maximum amount of contrast (Black to White Pixels) for the area of interest in your inspection. It is also important to point out that the contrast needs to be directly related to what you are trying to measure or inspect.

2) **Lighting** - Are you using the correct color of light for your part or application? Frequency is the number of oscillations per second, whereas wavelength is the distance between two points in the same position on the wave. Each different color spectrum, UV, Blue, Green, Yellow, Red, Infrared are all lighting frequencies that have different frequencies and wavelengths of light. This will determine how the surface of the object and camera will react when light is introduced. The intention is to use the light frequency that will create the greatest contrast and eliminate noise in your image. For example, metallic parts can sometimes be introduced to a system with a light coating of oil or with a slightly oxidized surface depending on the logistics of how they were stored. In a situation like this it is important to use the frequency of light that will reduce the amount of fluctuation that will occur when both types of these parts are introduced into the inspection system.



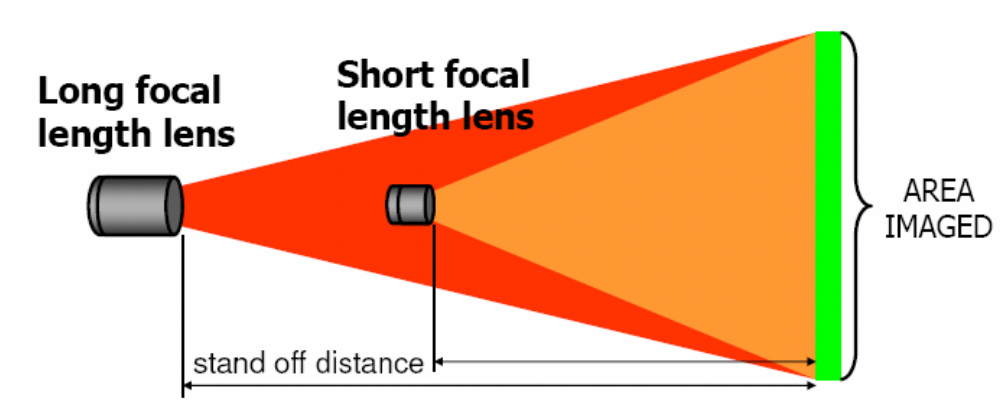



3) **Filtering** - Are you eliminating background or overhead lighting noise and other harsh environment disturbances with lens filters? By simply placing a filter on the camera lens that matches the frequency of lighting illuminating the part, ambient lighting disturbances can be removed.



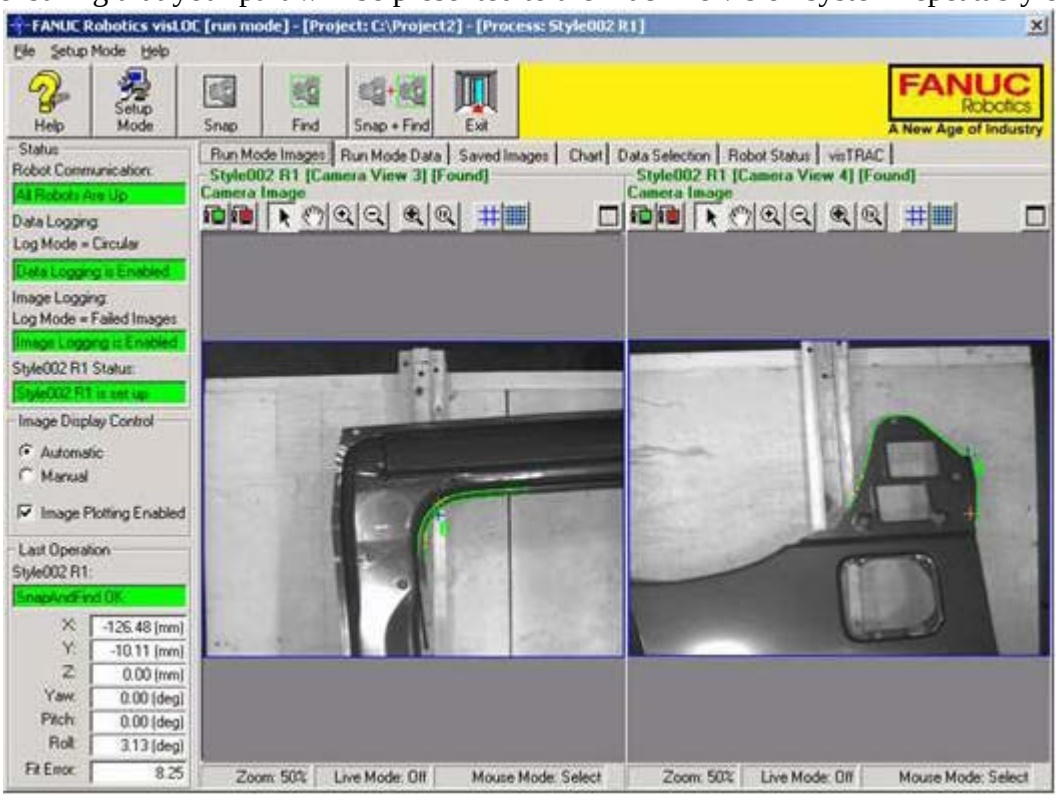

4) **Lenses** - Do you have the correct Field of View (FOV) and Region of Interest (ROI) including the pixel accuracy needed? The correct focal length lens will determine the size of the region your machine vision system can see and ultimately all the information that is collected. Calculating a FOV too large will result in less detail and accuracy, whereas calculating a FOV too small may result in inspection failure due to the part or object being out of the camera sight. When calculating the FOV it is important to determine the part or object maximum ROI and the maximum acceptable error of that region before deciding which focal length lens is most appropriate for your application. Sometimes this may be restricted by the working distance or height of the camera to the object, so all these factors

need to be accounted for, before you build your system.




A shorter focal length lens can image the same field of view as a longer focal length lens by decreasing stand off distance.

5) **Location** - Are the parts or application tolerances too wide to repeatably detect your part? Having a part that shifts out of the camera field of view can cause system instability. It is important to have some type of physical fixture that limits the motion of the object or part of interest. If the part shifts out of the camera view, failures will occur adding to unnecessary downtime. By providing a rough location of your part this instability can be eliminated ensuring that your part will be presented to the machine vision system repeatably each time.




6) **Calibration** - Is the system calibrated correctly and how do you test that the calibration was and is in conformance? Having a mastering fixture or calibration routine can ensure that your system meets the quality standards of your facility.

7) **Features and Fiducials** – In order to properly inspect an image the identification of a unique feature that is present in every inspection image can be used as a point of reference or what we call a fiducial. Fiducials represent a unique feature found in every inspection that can be used to reference vision tools in your inspection or detect if you have the correct part present in your image.

8) **Resolution** – Resolution determines the repeatability of your system. This allows you to quantify the size of a pixel to a measurement value. Determining the resolution of your system is important because it determines how accurate and repeatable your inspection can be. If you have a system in which the resolution is .5mm/pix and you need to measure a part +/- .1mm it may be impossible to ever achieve. This needs to be considered especially on quality measurement inspections and robot guidance. Resolution can also be enhanced by the power of the software you choose which can allow sub pixel accuracy.

9) **Stability** – Another important aspect to consider when setting up a machine vision sensor is the stability of the system. It is important to ensure that the mounting of your camera system and lights do not move or shift during your process. These items are what your system is calibrated too. Moving a camera doesn't mean that the camera can see that it has moved, it is only as smart as the programmer can make it. Also, when setting up the equipment it's wise to place the cameras and lights in areas with little to no vibration or in areas with little traffic so that the potential for the system to get bumped or moved is minimized.

10) **Testing** – In order to ensure that your machine vision system is working properly it is important to have a system that can be periodically checked to ensure that defect parts are being captured and rejected by the system. A testing procedure can be built directly into the system to ensure that the process is easy and efficient. These test parts are referred to as "rabbit parts", which can be placed into the system at anytime to verify the systems proper functionality.

Each of the areas mentioned above are critical aspects of ensuring that machine vision will be a successful process in your facility

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