HP Photosmart Digital Cameras

Real Life Technologies

HP Adaptive White Balance

What is adaptive white balance?

The human visual system (your eye + your brain) adapts quickly to changes in the color of the light that illuminates our world. Objects that appear under sunlight to be a certain color, such as gray, still look the same color when illuminated by tungsten light. This happens even though the tungsten light is very yellow compared to sunlight.

Digital cameras must accurately determine the color of light on a scene and correspondingly adjust the white balance of each photo in a way that mimics the eye. In a traditional film camera – this adaptation, if it happens, happens in the print process. Determining white balance is one of the most challenging aspects of photography – digital or analog.

What is unique about HP's adaptive white balance?

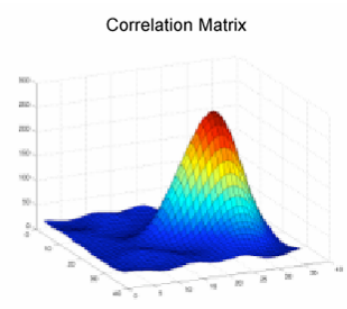
HP color scientists developed a family of algorithms to automatically adjust white balance under a wide range of conditions, and with remarkable accuracy. Part of the reason is the unique 'model of the real world' approach HP has taken in our adaptive white balance routines. The success of HP digital cameras in this regard has been well recognized in a number of independent reviews.

How did HP do this?

There are up to 6 different white balance algorithms used in the white balance determination routines in HP digital cameras. Each of these algorithms has strengths and weaknesses in different photographic circumstances and reports information on it's own confidence. HP evaluates the results from the various approaches, combines this information with other information about the state of the camera (for instance, did the strobe fire, what are the exposure settings, etc) and chooses the best white balance for each photo. Note that these 6 methods are methods used in automatically determining white balance of a scene in auto mode, not 6 different "manual white balance" modes. Many HP cameras also allow the photographer to choose a white balance, such as tungsten or fluorescent, and also allow the photographer to manually set the white balance based upon a white object in the scene.

Color by Correlation

One of the cornerstone algorithms in HP adaptive color balance is called color by correlation. Color by correlation begins by making accurate measurements of the colors observed by the camera sensor. To do this well, each camera receives an individual color calibration during manufacture.

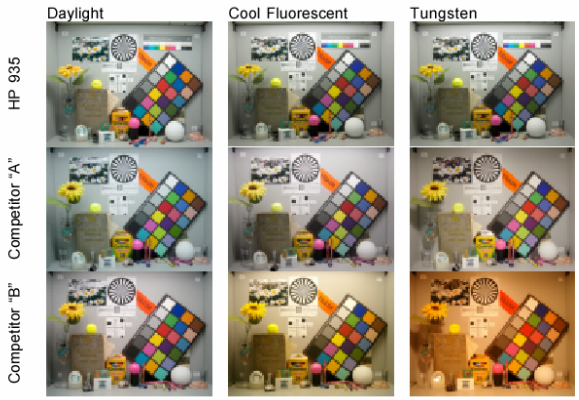


The camera evaluates the following question for each different color of light that might illuminate the scene: "How likely is it that this light would have produced the colors that were measured by the CCD?" For each measured color, its probability is summed to form a total probability. The illuminant with the highest probability sum is declared the winner.

To do this quickly the camera uses pre-calculated correlation matrices. These are just convenient ways to store the probability of observing each color. The figure to the left shows one of these correlation matrices for an HP digital camera.

What types of illumination does this handle?

HP's adaptive white balance algorithms handle a very wide range of illuminants - from the bluish light of outdoor shade, full sun, 3 different types of fluorescent lamps, to yellowish tungsten lights, including mixed illuminate cases. It can be difficult to successfully identify this wide range of light sources; some cameras have special difficulties with tungsten lights.



To the left are actual photos taken in under different illuminants. Results for three cameras are shown — the HP935 and two competitors. Remember, the correct answer is that the images should look the same regardless of the illuminant because that is what we see.

Manual White Balance

There are situations where any automatic white balance routine fails – or where the photographer wants a special effect. For these cases, many HP Photosmart cameras include both selectable white balance modes (such as tungsten, florescent, etc.) and a manual white balance mode. In manual mode the photographer indicates (by pointing the camera at it) the item that the camera should consider "white" – or really "neutral". The camera then calculates the proper white balance for that item and applies it to subsequent photographs.