# Pnmhisteq User Manual

**pnmhisteq**

Updated: 10 September 2005
Table Of Contents

## NAME

pnmhisteq - histogram equalize a PNM image

## SYNOPSIS

**pnmhisteq** [**-gray**] [**-rmap** *pgmfile*] [**-wmap** *pgmfile*] [**-verbose**] [*pnmfile*]

You can abbreviate any option to its shortest unique prefix.

## DESCRIPTION

This program is part of Netpbm.

**pnmhisteq** increases the contrast of a PGM or PPM image through the technique of "histogram equalization."[1]

**pnmhisteq** computes a histogram of the luminosity of the pixels in the image. It then calculates a mapping between each luminosity and a new luminosity such that it spreads out intensity levels around histogram peaks and compresses them at troughs. I.e. it moves pixels around in the histogram so as to make it flat. It applies that mapping to the input image to produce the output image. The effect of this is that the image has equal numbers of pixels at each possible intensity level, which means it uses the available levels of intensity more efficiently and thereby has more visible detail.

Mathematically, the luminosity mapping is this: Assume the pixels are sorted by luminosity into *B* buckets numbered from 0 (lowest luminosity) to *B*-1. *N[i]* is the number of pixels in bucket *i*. *T* is the total number of pixels (sum of *N[i]* over all *i*). *W* is the luminosity of white.

**pnmhisteq** replaces an input pixel whose luminosity falls into bucket *j* with one whose luminosity is:

```
 j
---
    > (N[i] / T) * W
/
---
i=0
```

Considering a grayscale image for simplicity, this means that pixels in the most luminous bucket become white. Pixels in the 10th per centile of luminosity become 10% of white.

If you're processing a related set of images, for example frames of an animation, it's generally best to apply the same luminosity mapping to every frame, since otherwise you'll get distracting frame-to-frame changes in the brightness of objects. **pnmhisteq**'s **-wmap** option allows you to save, as a PGM image, the luminosity map it computes from an image. The **-rmap** option causes **pnmisteq** to use such an image as its luminosity map.

So you can run **pnmhisteq** with **-wmap** on a composite you created with **pnmcat** of the images you intend to process. Then, you can run **pnmisteq** with **-rmap** on each of the individual images, using the luminosity map you generated from the composite.

## OPTIONS

**-gray** When processing a pixmap, only gray pixels (those with identical red, green, and blue values) are included in the histogram and modified in the output image. This is a special purpose option intended for images where the actual data are gray scale, with color annotations you don't want modified. Weather satellite images that show continent outlines in color are best processed using this option. The option has no effect when the input is a graymap.

**-rmap** *mapfile*Process the image using the luminosity map specified by the PGM file *mapfile*. The PGM image, usually created by an earlier run of **pnmhisteq** with the **-wmap** option, contains a single row with number of columns equal to the maxval (greatest intensity value) of the image plus one. Each pixel in the image is transformed by looking up its luminosity in the corresponding column in the map file (column number = luminosity) and changing it to the value given by that column.

**-wmap** *mapfile*Creates a PGM file *mapfile*, containing the luminosity map computed from the histogram of the input image. This map file can be read on subsequent runs of **pnmhisteq** with the **-rmap** option, allowing a group of images to be processed with an identical map.

**-verbose**Prints the histogram and luminosity map on Standard Error.

## LIMITATIONS

Histogram equalization is effective for increasing the visible detail in scientific imagery and in some continuous-tone pictures. It is often too drastic, however, for scanned halftone images, where it does an excellent job of making halftone artifacts apparent. You might want to experiment with **pnmnorm** and **pnmgamma** for more subtle contrast enhancement.

The luminosity map file supplied by the **-rmap** option must have the same maxval as the input image. This is always the case when the map file was created by the **-wmap** option of **pnmhisteq**. If this restriction causes a problem, simply adjust the maxval of the map with **pamdepth** to agree with the input image.

If the input is a PBM file (on which histogram equalization is an identity operation), the only effect of passing the file through **pnmhisteq** will be the passage of time.

## SEE ALSO

**pnmnorm**, **pnmcat**, **pamdepth**, **pnmgamma**, **pnm**,

[1] Russ, John C. The Image Processing Handbook. Boca Raton: CRC Press, 1992. Pages 105-110.

## AUTHOR

Copyright (C) 1995 by John Walker (kelvin@fourmilab.ch). WWW home page: http://www.fourmilab.ch/

Permission to use, copy, modify, and distribute this software and its documentation for any purpose and without fee is hereby granted, without any conditions or restrictions. This software is provided "as is" without express or implied warranty.

---

**Table Of Contents**

NAME
SYNOPSIS
DESCRIPTION
OPTIONS
BUGS
SEE ALSO
AUTHOR