

Java Watermarking Tool (JWMTTool©)

- User Guide -

Java Watermarking Tool© is a simple Java utility tool that allows the user to study and see the effects of different watermarking attempts on a YUV (4:2:2) file.

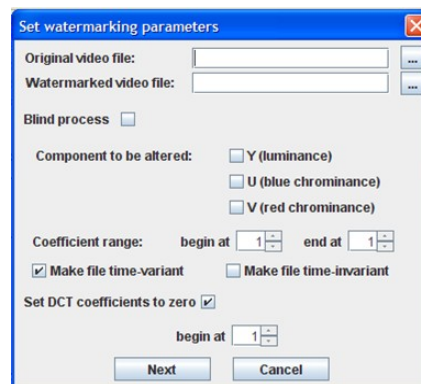
A YUV video file, just as any video file, consists of frames. Each YUV video frame contains, separately, Y (luminance), U (blue-chrominance) and V (red-chrominance) components data. During the watermarking process, each of the components data is arranged into 8x8 blocks and the DCT transform is applied to each of these blocks. The DCT transform translates data from the spatial domain into the frequency domain. The 64 DCT transformed coefficients are then altered to insert the watermark, according to the user preferences. After that, an inverse DCT is applied to go back to spatial domain before display¹.

JWMTTool© Set up

After downloading JWMTTool©, uncompressing the file will create a directory named JWMTTool and several JWMTTool© UML diagrams. To execute the application, follow the instructions on file README under directory JWMTTool.

JWMTTool© Use

Before actually running a watermarking attempt, the user must set up his/her watermarking preferences. To do so, select “Configure” from the Watermarking menu.



This will bring up the `Configure` dialog shown above. Here, location of original video file to be used and desired output file destination should be input.

Selecting to run a “Blind process” hides from the user which one of the final frames that are presented after the watermarking process is the original video and which is the watermarked one. Instead of labeling them, it will randomly place the watermarked video, either on the left or right. Otherwise, the original video will be on the left and watermarked one on the right after

¹ Since the first (#0) coefficient is the most important of all (so important that changing it distorts the image by a significant amount), the tool doesn't really allow the user to change it, meaning that the modifications are made on the 63 remaining coefficients.

watermarking.

Then, the user can select the components to be altered: Y (luminance), U (blue chrominance) and/or V (red chrominance). The coefficient range where the watermark will be inserted has also to be selected, and so does the type of watermarking to be performed:

1. *Time-Variant*: All the frames in the video will have a unique watermark, based on a key (i.e. the key itself will be the watermark). An integer key to watermark the first frame will be needed, and all the subsequent keys will be generated according to the following sequence:

$$\begin{aligned}
 & x_1 \\
 & x_2 = (x_1 + N) \bmod P \\
 & x_3 = (x_2 + 2 * N) \bmod P \\
 & \dots \\
 & x_i = (x_{i-1} + (i-1) * N) \bmod P
 \end{aligned}$$

for some numbers N and P (where P must be larger than the total number of I-frames in the video to be watermarked). JWMTTool© uses the user input key as x and

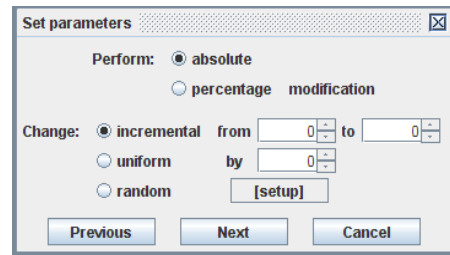
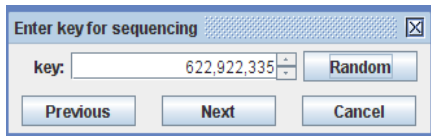
$$\begin{aligned}
 N &= 2^{30} \\
 P &= 2^{32} + 1
 \end{aligned}$$

When time-variant watermarking is chosen, the range of the DCT coefficients to transform must be 4, 8, 16 or 32.

2. *Time-Invariant*: All the frames in the file will have the same watermark, based on further configuration.

There is also an option to set the DCT coefficients to zero from a certain point. Of course, if a coefficient value that falls within the range of the coefficients to watermark is chosen in this case, that part of the watermark will be lost.

The **Next** button will take the user to one of two following screens:



The one on the left if the time-variant option was chosen (a dialog to input the key to be used for sequencing), or the one on the right if the time-invariant option was selected. In this case, two different watermarking strategies can be performed: *absolute* or *percentage* modification of the 63 AC coefficients.

The absolute change can be set-up to behave in one of three ways:

- a. *Incremental*: The coefficients will be incremented by `initial` value for the first coefficient, `(initial+1)` value for the second and so on, until the `final` value is reached. At that point, the sequencing wraps around and starts at the `initial` value again.
- b. *Uniform*: It changes the coefficients by a fixed amount.
- c. *Random*: It changes the coefficients based according to a function that can be tuned opening the corresponding setup dialog.

As far as percentage change is concerned, it can only be made using a uniform value.

If everything is set correctly, `Next` button will finally show the “Done” screen, and JWMTTool© will be ready to execute (`Watermarking >Execute`). When the watermarking process completes, the original and watermarked videos will be shown side by side.

- Appendix -

How to set up an environment variable under Linux

As explained in the README file, JWMTTool© need a Java virtual machine installed, as well as an environment variable called JAVA5_HOME pointing to its location. Java installation directory might be somewhere like

```
/opt/jdk1.5.0
```

or similar. To create an environment variable called JAVA5_HOME, open a shell console and type:

```
export JAVA5_HOME=/opt/jdk1.5.0
```

To make the definition permanent, add the previous line to the `.bashrc` (or shell-equivalent) file in your home directory.

How to set up an environment variable under Windows

As explained in the README file, JWMTTool© need a Java virtual machine installed, as well as an environment variable called JAVA5_HOME pointing to its location. Java installation directory should be somewhere like

```
C:\Program files\Java\jre_1.5.0_12
```

or similar. Inside that installation directory there should be a subdirectory called "bin", containing an executable program "java.exe" (among others). Open

```
Control Panel > System > Advanced Options > Environment Variables
```

and add a new "User Environment Variable" named JAVA5_HOME with that path as value.