

Guide to making high quality, reusable videos for presentation of research work

Doug Lipinski – February 3, 2013

There are several key considerations when making videos relevant to your research:

- 1) Minimal amount of work to create the video
- 2) High quality results
- 3) Watermark with information about the group

In this document I will lay out a procedure that meets all these requirements in a few simple steps.

Step 1: Generate a series of high quality images that will make up your video

The most common way to do this is probably by saving a series of images from MATLAB figures so that is the specific example I will discuss here. There are many considerations that go in to this process to ensure a high quality end product.

First, you should always be aware of color schemes, font sizes, line widths, point/marker sizes, and meaningful titles/axis labels on all your plots. The simplest way I have found to do this is to get an individual plot set up so it looks as nice as possible and then reuse that identical setup for all your plots in the image sequence. This includes the figure size as well. Make the figure the size you would like the final video to be and then get that figure size and reuse it. You can get the size of figure(N) with the command

```
P=get(1, 'position');
```

which will return a vector that contains

```
P=[x_position y_position width height].
```

You can then reuse this size by manually setting the position via

```
set(1, 'position', [x0 y0 width height]);
```

There are too many plotting methods and options to discuss here, but some specific properties you will probably want to set are

```
LineWidth      MarkerSize      FontSize
```

The next step is to make a series of plots (usually inside a for loop) and export an image of each plot. I have found that the `export_fig` package does a very nice job of this and has many nice options as well. You can download `export_fig` here: <http://www.mathworks.com/matlabcentral/fileexchange/23629-exportfig>

You'll need to make sure the `export_fig` folder is in your MATLAB path by creating a file `~/Documents/MATLAB/startup.m` that contains the line:

```
addpath(genpath('/path_to_folder/export_fig/'));
```

where `path_to_folder` is the full path to the `export_fig` folder (probably `~/Documents/MATLAB/export_fig/` is a good place to put it).

Then, to save you images, do something like the following:

```
for i=1:100
    %do stuff
    ...
    ...
    %plot stuff
    ...
    ...
    ...
    %output image filename (index with zero-padded 4-digit integers)
    filename = sprintf('images/image%04d.jpg', i);
```

```

%export the image
export_fig(gcf, filename, ...
           '-r72', '-q95', '-transparent', '-nocrop');
end

```

See the `export_fig` documentation for the full list of options available, but the main idea is to output .jpg files (hence the .jpg filename) using the current figure (`gcf`) at screen resolution (`'-r72'`) using high quality images (`'-q95'`). It's also usually good to turn off the image cropping (`'-nocrop'`) and use a transparent background which shows up as white in jpeg's (`'-transparent'`). Note that if you're exporting images for use in a paper you will probably want to export .pdf files or at least increase the resolution a lot. Also, .png files often look nicer in papers than .jpg's.

Step 2: Include the group info on each image

You should add the group info to each image. You can do this directly in the MATLAB figures if you want, but I've found that it looks nicer to use a watermark technique after you've saved the actual image files. To do this, you must first generate a .png file containing the watermark you want to use. For example, I recently used the following image across the bottom of the video:

Dr. Doug Lipinski &
Prof. Kamran Mohseni

UF | College of Engineering
UNIVERSITY of FLORIDA

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You can download the UF primary and secondary logos here:

<http://www.identity.ufl.edu/resources/signature-system/>

<http://www.identity.ufl.edu/resources/secondary-logos/>

You should then use a program like inkscape, xfig, illustrator, photoshop, or gimp to create a .png image that is the same size as your exported images, but contains just a transparent background and the watermark (where you'd like it located).

To apply the watermark .png file to a file named `img0001.jpg` and name the output `WMimg0001.jpg` use the following script:

```

#!/bin/bash

#loop over all images (from 1 to 501 in this case)
for i in {1..501}; do

    #Image number with prefix of zeros
    num=$(printf "%04d" $i)
    echo $(printf "Watermarking image number %4d" $i)

    #use the convert tool to overlay the watermark on each image
    convert -page +0+0 img$num.jpg -page +42+344 watermark.png -
background transparent -layers merge -quality 95 WMimg$num.jpg
done

```

Note that if your watermark image is not the same size as your main image files, you can adjust the offset of the watermark.png image to place it where you want. Also, you should set the transparency you want when you create the png file.

Step 3: Combine the images into a video

Use the command line tool `ffmpeg` to combine the images into a video. I've found that the following options usually work well:

```
ffmpeg -r 24 -qscale 2 -i WMimg%04d.jpg output_file.mp4
```

This will use a frame rate of 24 frames per second and a high quality (`-qscale 2`). Note that lower numbers for the `-qscale` flag correspond to higher quality video encodings. You can try altering the frame rate to make your video play slower (or faster) and decrease the quality if you want smaller output files. Also, the numbers in your image files must start at 0 or 1 or `ffmpeg` will give an error.

Addendum: Movie making tips

Peter Zhang

Here are some additional tips for making movies. They may not necessarily be the best way to do things, but they have been helpful to me.

- To find movie frame and width, use the commands

```
sips -g pixelHeight image.jpg  
sips -g pixelWidth image.jpg
```

- If using illustrator, resize art board to be same size as movie images. To save watermark, use 'save for web' option and save watermark as png with transparent background
- Make movie with following command. The option `-pix_fmt yuv420p` is necessary to make movies compatible with quicktime on macs. This is important as this ensures that it will play on Kamran's computer and work in powerpoint on mac.

```
ffmpeg -r 24 -i WMimg%06d.jpg -qscale 2 -pix_fmt yuv420p movie.mp4
```

- To create title segment of movie, create image with illustrator that is same size as the movie images. The following command will create a 5 second movie from 1 image. Duration can be adjusted with the `-t` option

```
ffmpeg -loop 1 -i title_image.jpg -c:v libx264 -t 5 -pix_fmt yuv420p title.mp4
```

- To combine movies create a `movielist.txt` file with the contents:

```
file '/path_to_file/title.mp4'  
file '/path_to_file/movie.mp4'
```

- To combine title movie and research movie, use the command

```
ffmpeg -f concat -i movielist.txt -c copy combined_movie.mp4
```