Tour de Chateau

Automated filtering of
Tour de France footage
with Linux

Malcolm Herbert
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Tour de France

A multiple stage bicycle race primarily held in France, while also occasionally making passes through nearby countries. First organized in 1903 to increase paper sales for the magazine L'Auto, it has been held annually since its first edition in 1903 except for two World Wars. As the Tour gained popularity it has lengthened to 21 days and its reach has extended around the globe. Participation has expanded from a primarily French field, as riders from all over the world began to take part.
(thanks wikipedia)

Televising the Tour

French broadcasters France 2 and 3 organise the Tour broadcast with equipment including:

- a staff of 300
- four helicopters
- two aircraft
- two motorcycles
- 35 other vehicles and trucks (edit suite, comms)
- 20 fixed cameras
- local Australian DVB broadcast by SBS television

So far so good, but ...

- Each broadcast typically four hours
- I'm not amazingly interested in road cycling
- Too many shots of sweaty fit men on bicycles
- Usually good commentary, but often inane
- Whilst there are scenery shots, difficult to find
- On holiday, missed several days, hard to catch up
- 4 hour DVB SD files are 5.9GB, HD files 17GB (!)
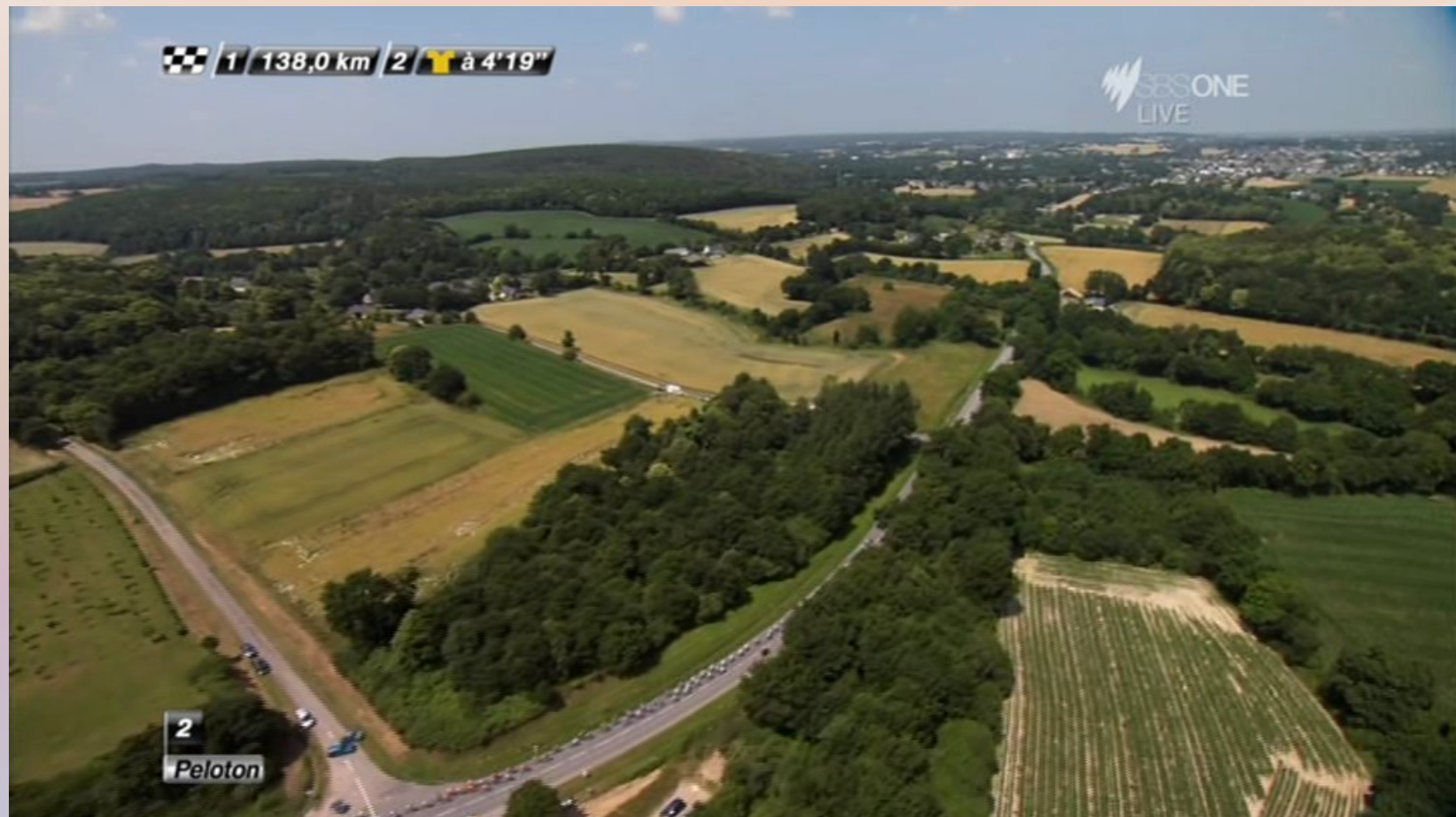
Bad

Good

Bad

Good

Terrible

Good

Bad

Good

Bad

Good

Terrible

Bad

Good

Bad

Good

Terrible

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Terrible

Good

Bad

Good

Bad

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Terrible

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Terrible

Good

Bad

Good

Bad

Good

Terrible

FROM **$15,990***DRIVE AWAY

*Drive away price for a ŠKODA Fabia manual 63MPI limited edition (no added options) available at participating ŠKODA dealers on stock vehicles ordered and delivered between June 1, 2013 and August 31, 2013. While stocks last. Excludes fleet, government and rental buyers. Not available with any other offer.

Good

Bad

Good

Bad

Good

Terrible

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Good

Good

Good

Good

So - helicopter shots

- Most interesting shots of scenery or buildings are from the helicopter-mounted cameras

- Broadcast audio tends to have helicopter sound mixed in

- Engine turbine clearly audible during shots

- External shots do not feature tone, from cabin only

- Audio much, much easier to process than video

Fast Fourier Transforms 101

- Digital Systems tool to convert time-domain signal into frequency-domain signal

- Used to be processor intensive, now not so much

- Many different tools available

- Chose to use sndfile-spectrogram due to simplicity

- Takes WAV input, outputs PNG

- Ultimately want to use python's numpy to do this bit, but not gotten there yet

"Boring" shot FFT
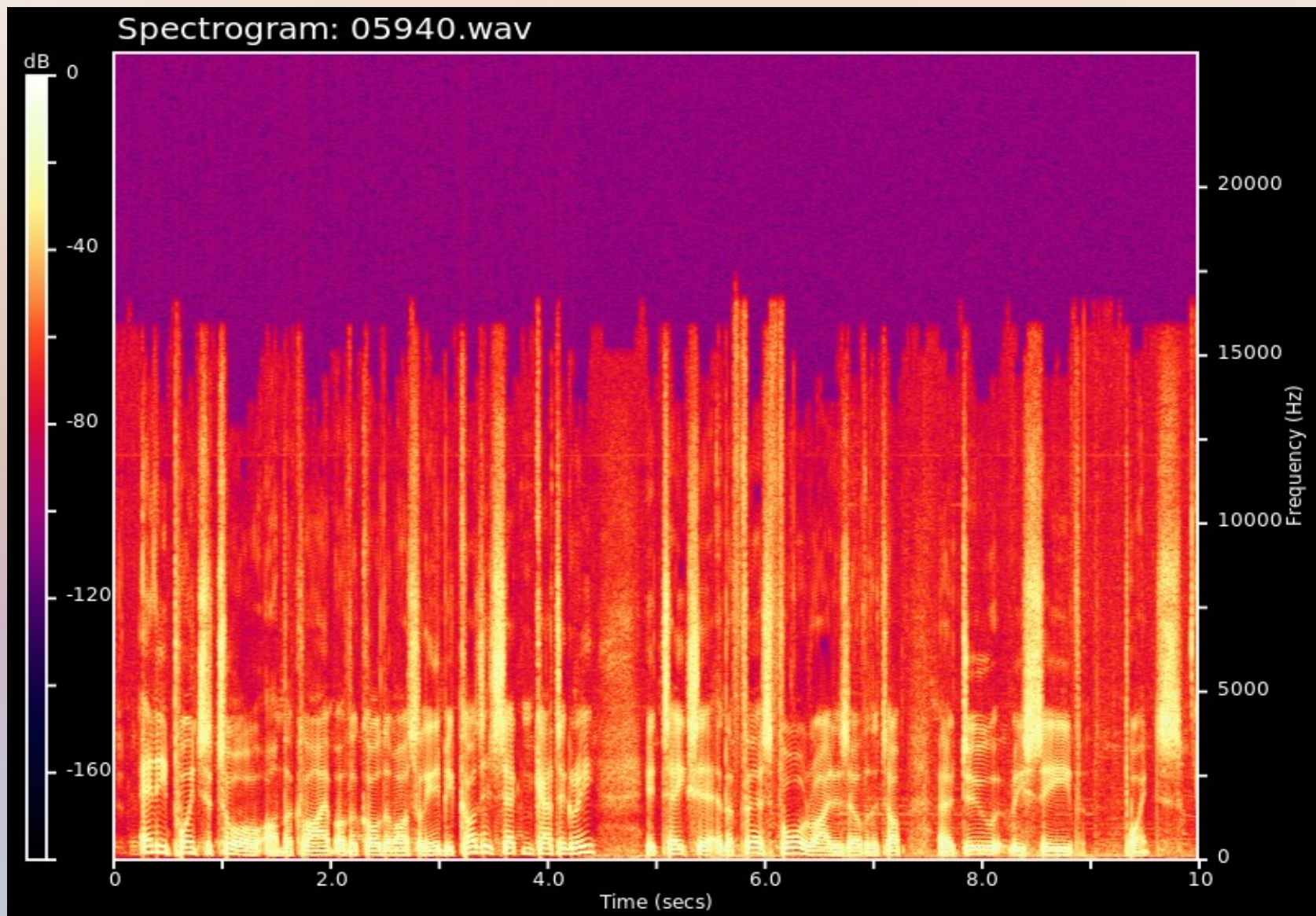
"Interesting" shot FFT
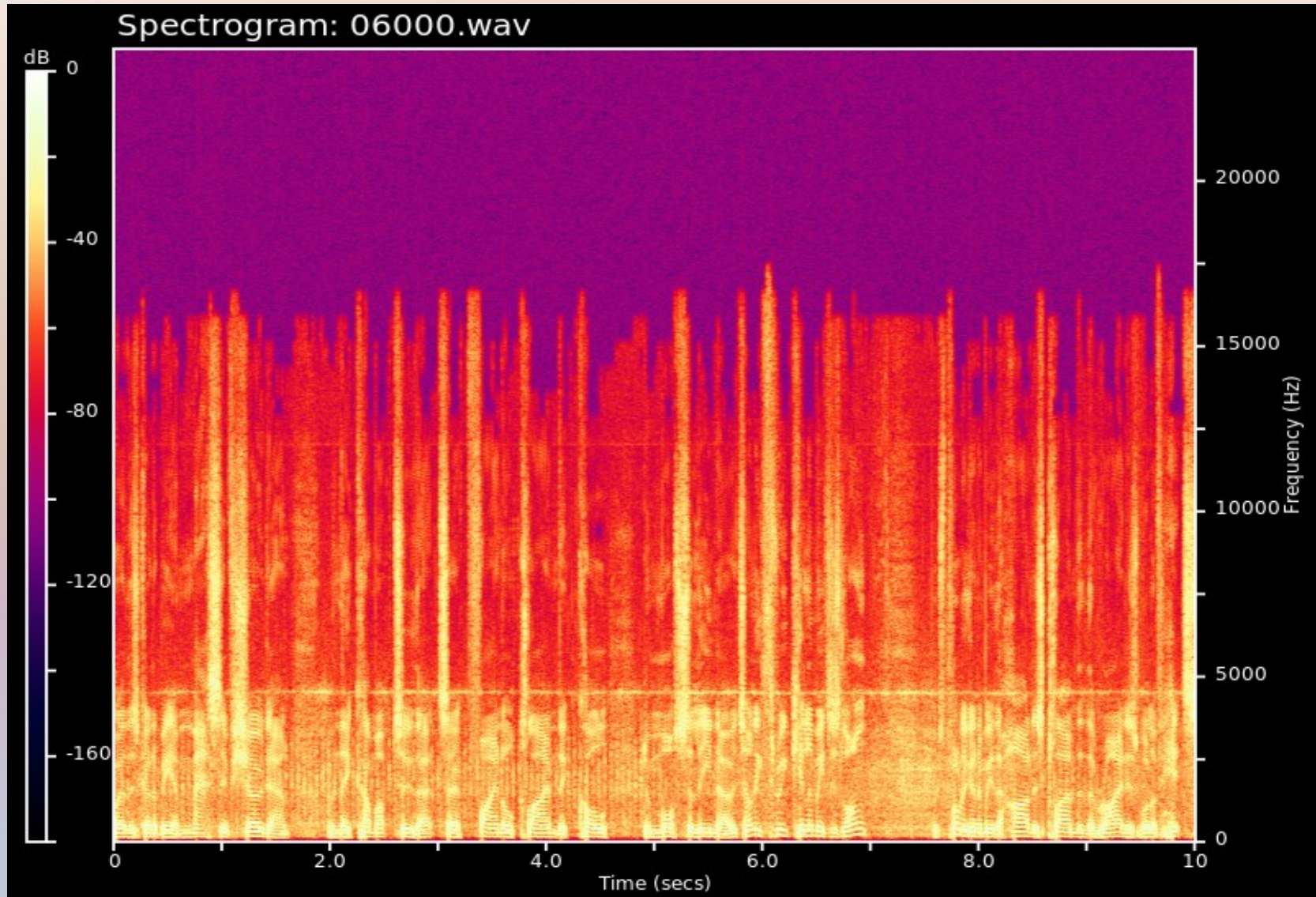
Prototype processing method

- mplayer to play/dump audio from DVB MPEG TS
- mp3splt to chop into small chunks
- mpg123 to convert each to PCM
- sndfile-spectrogram to convert to PNG
- netpbm suite to isolate tone
- perl script glue to create edit decision list
- mencoder to convert MPEG to Xvid with EDL

Image processing

- Use image processing tools to enhance tone line
- Convert to grey scale
- Normalise to reduce noise floor
- Convolute with mask to identify shape
- Crop to isolate area of interest
- Sort histogram of pixels for simple determination

Convolution 101

- Old (but simple) image processing technique

- Define a square odd-sided greyscale/colour bitmask

- Moves mask around input image, centred on midpoint of mask

- Each output pixel values are the normalised sum of original and mask pixels multiplied together

- Mask shapes help enhance similar in original

- Can be tricky to get mask sizes and values correct
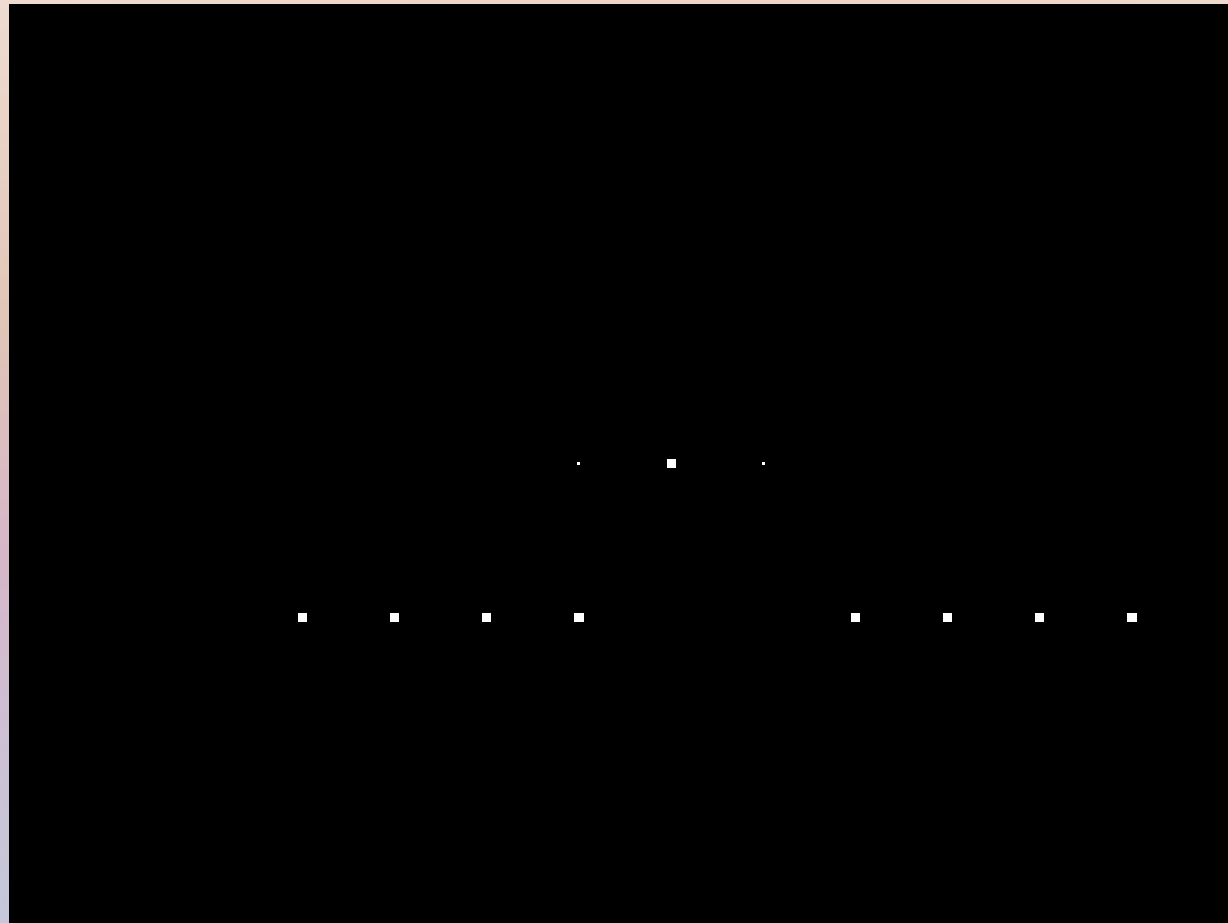
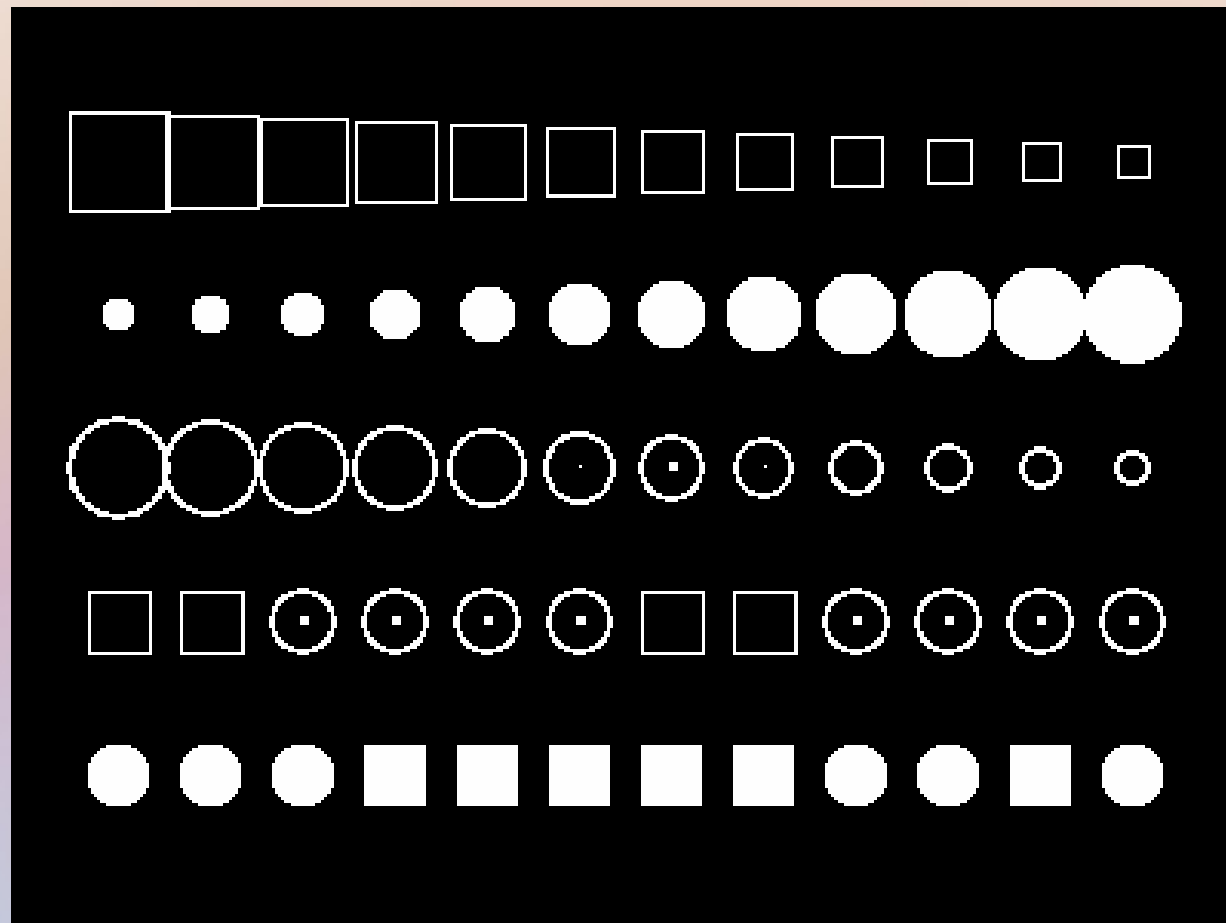- May not work with very noisy sources

Convolution example - input
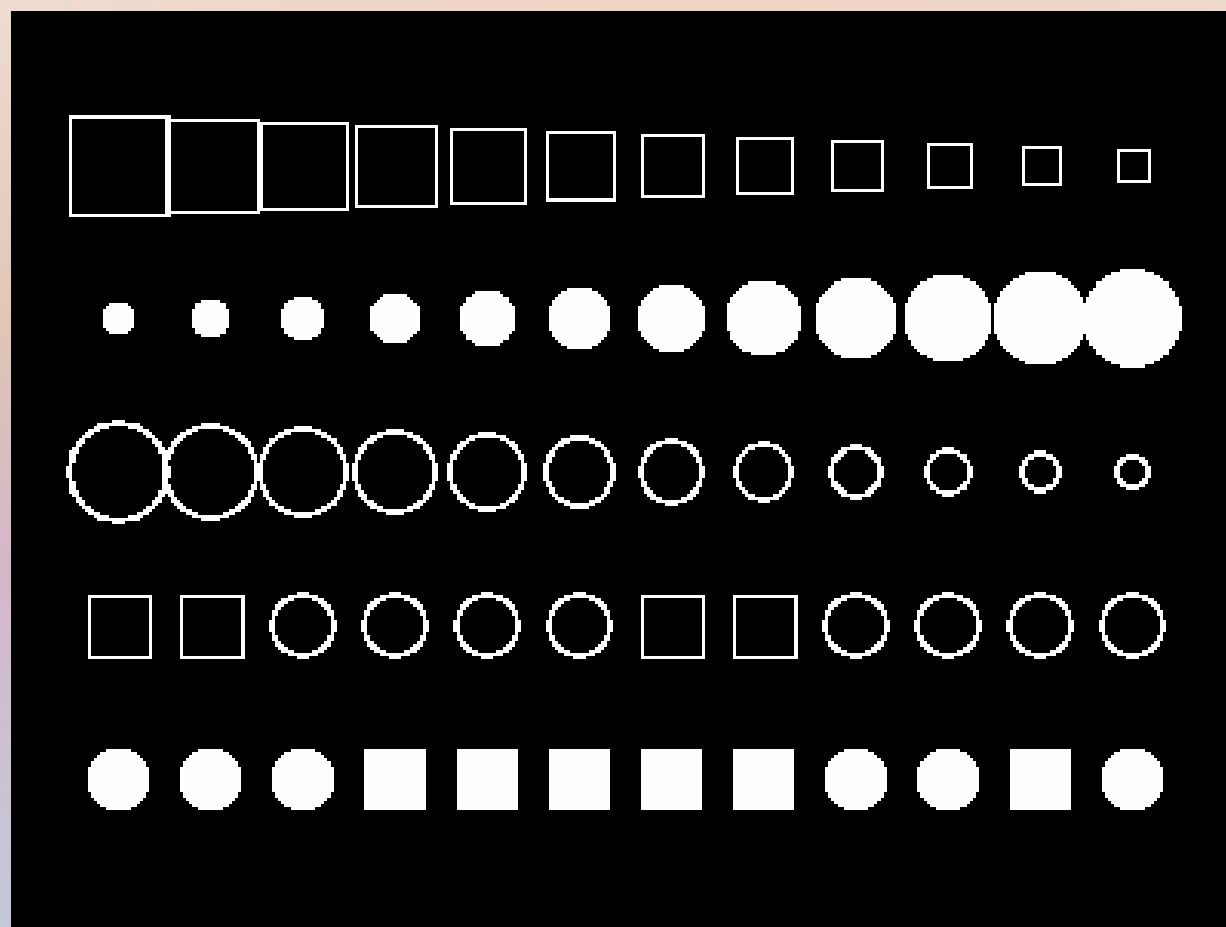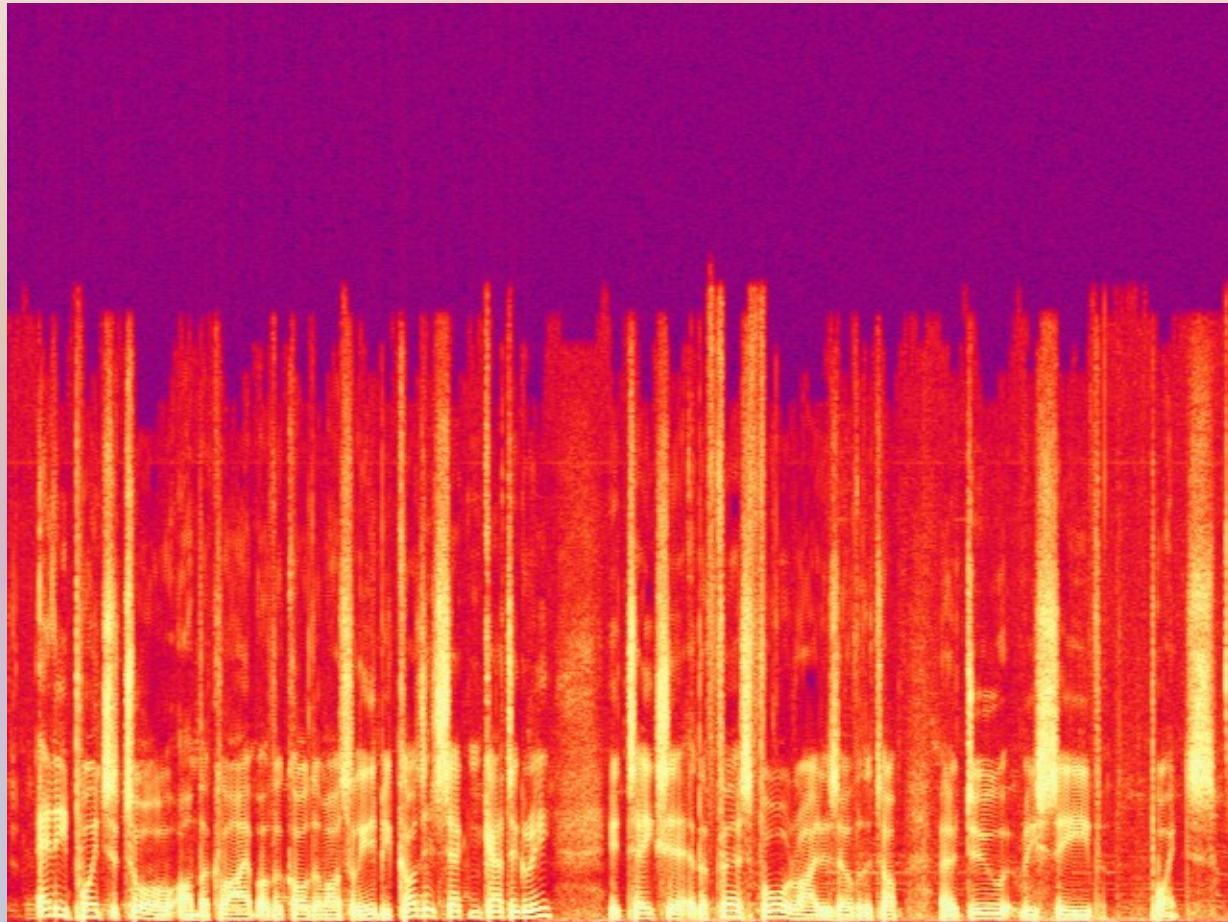
Convolution example - mask
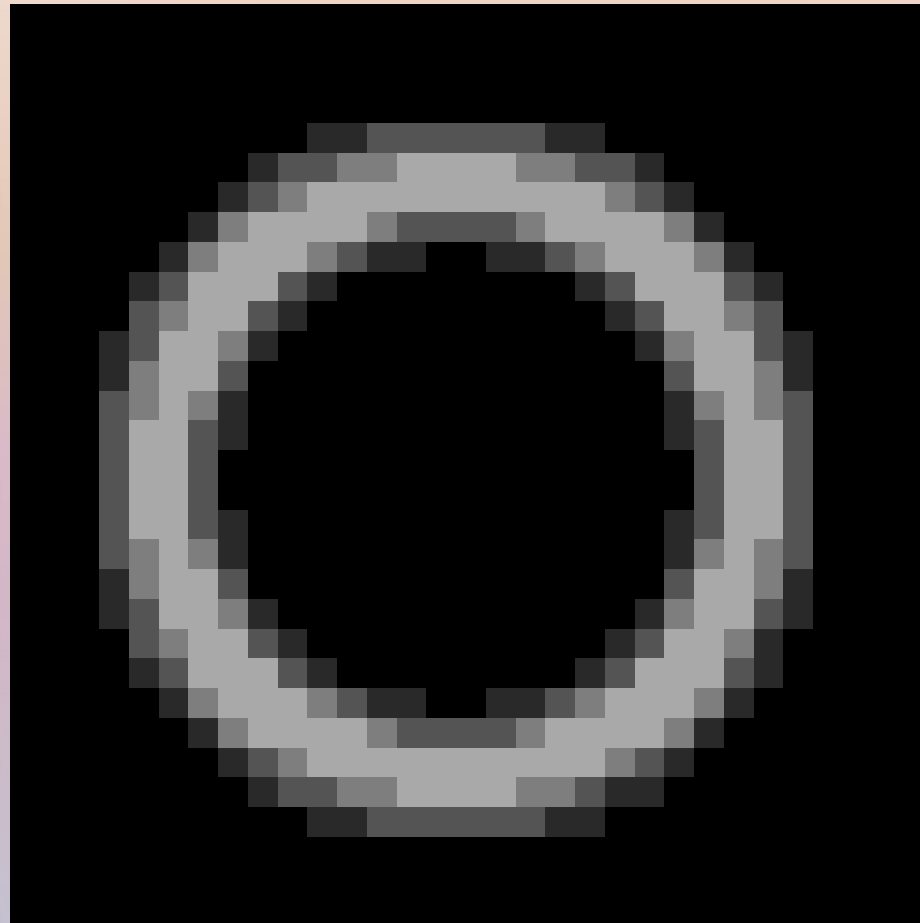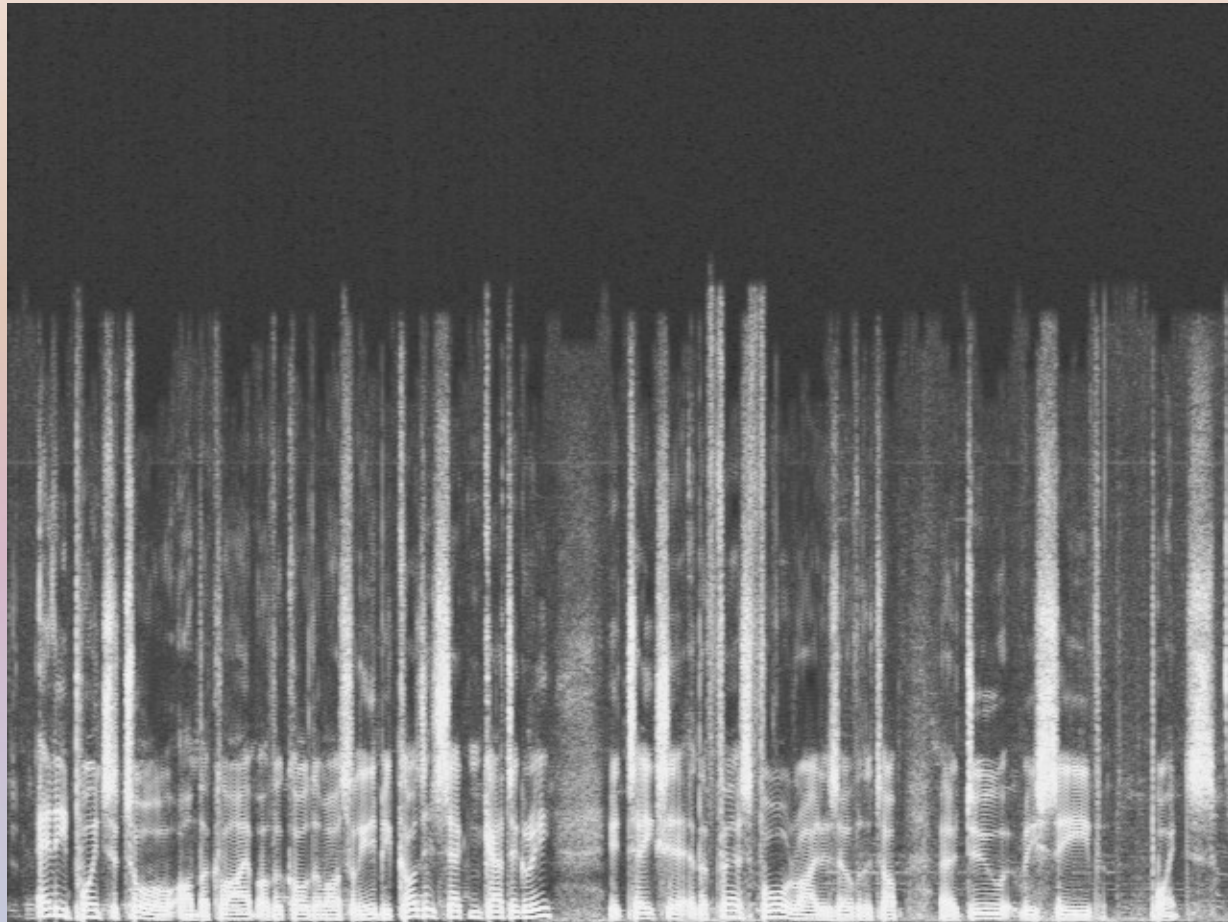
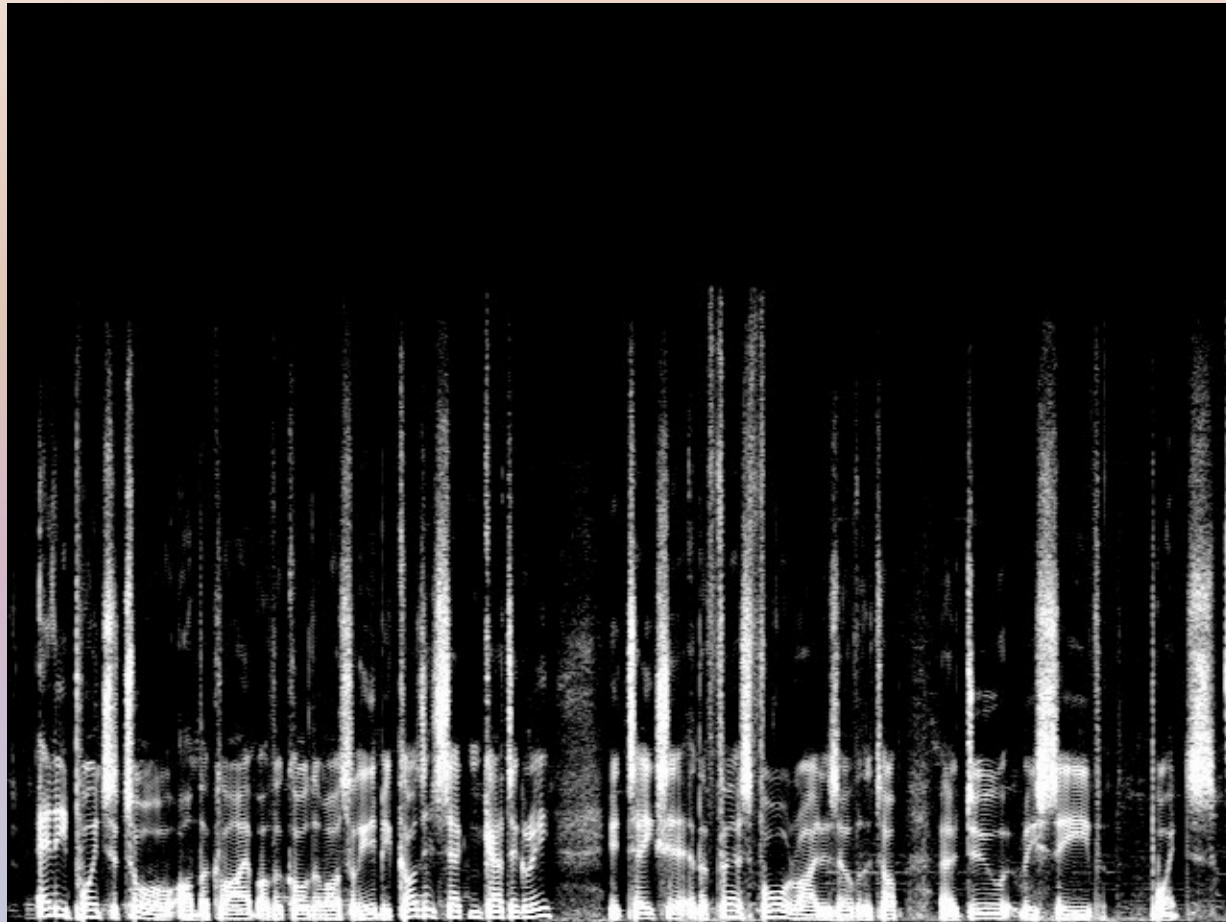# Convolution example - output

Convolution example - compared
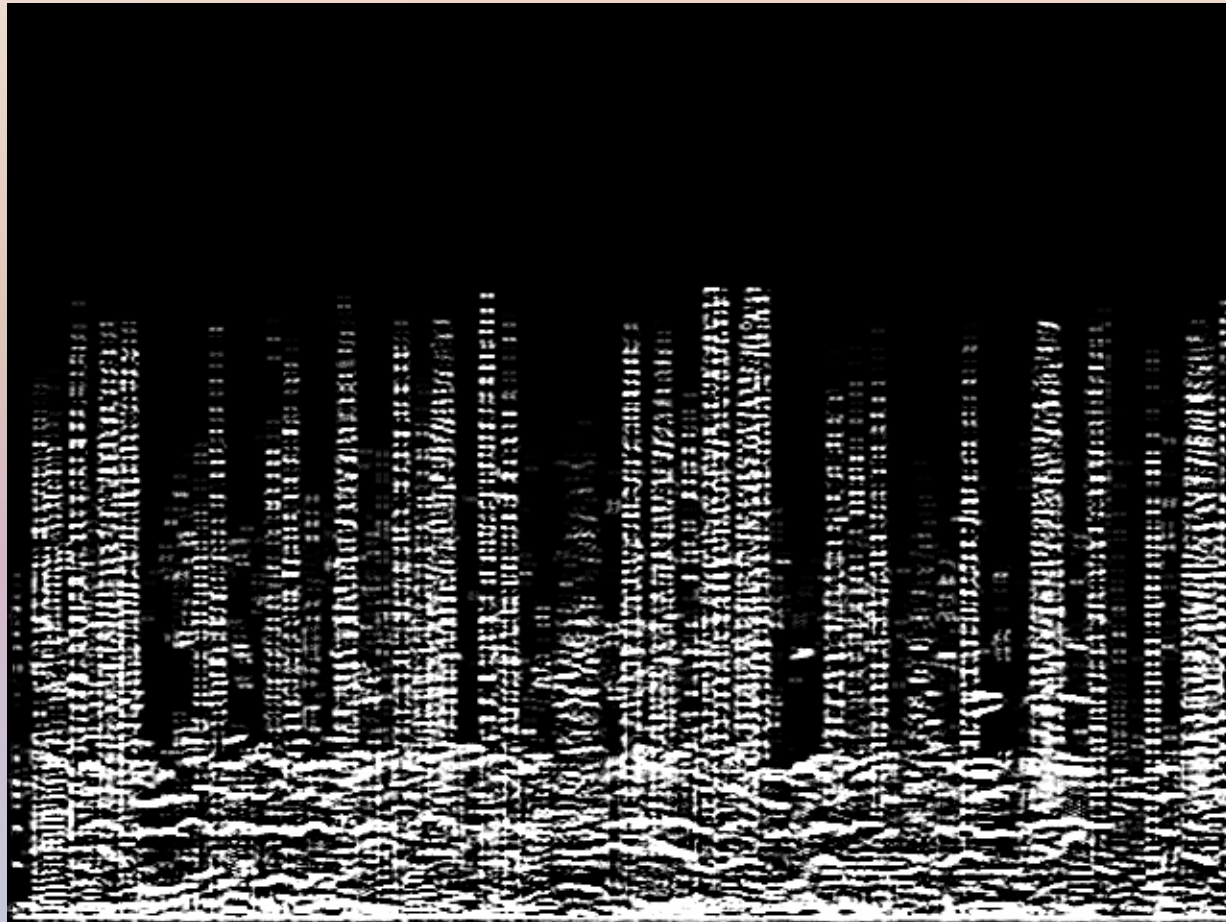
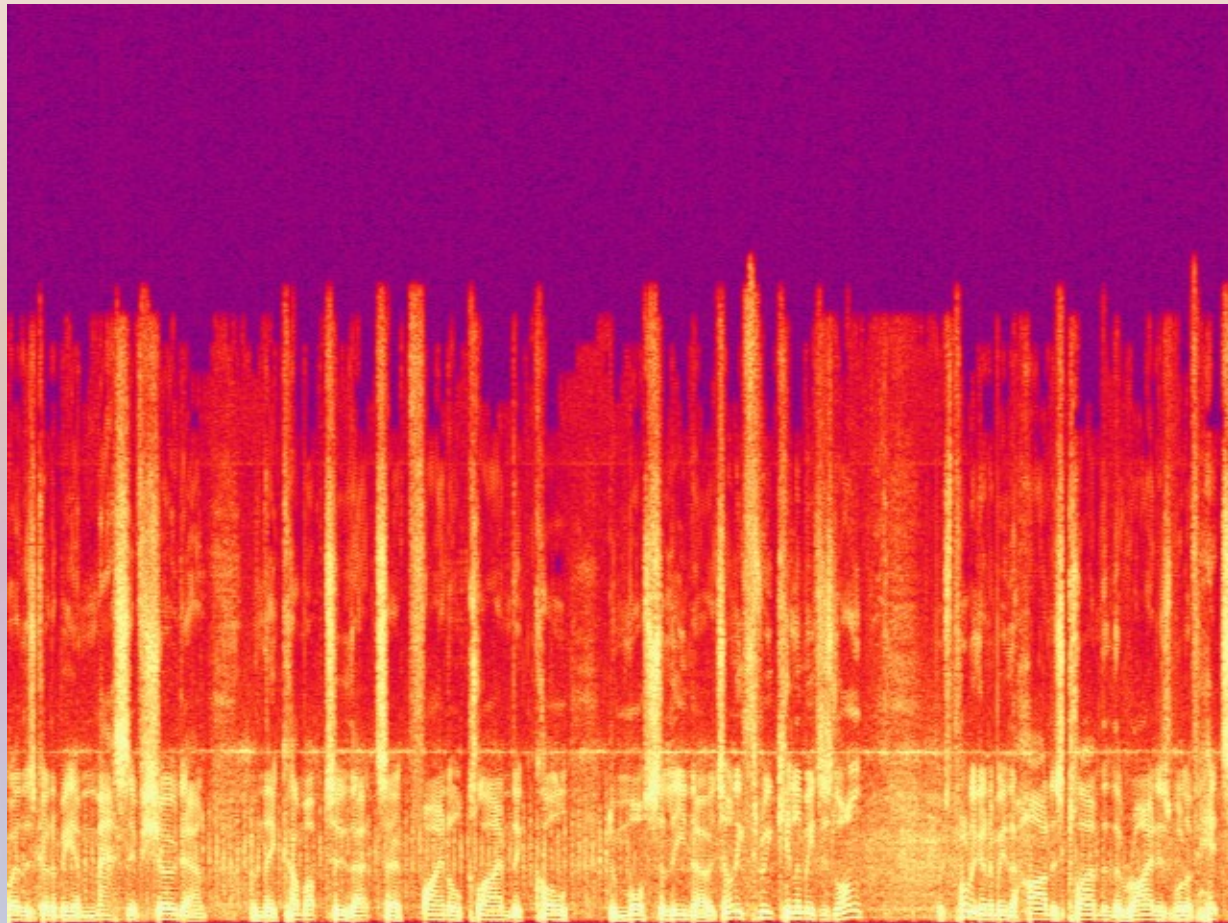# Original "boring" FFT PNG
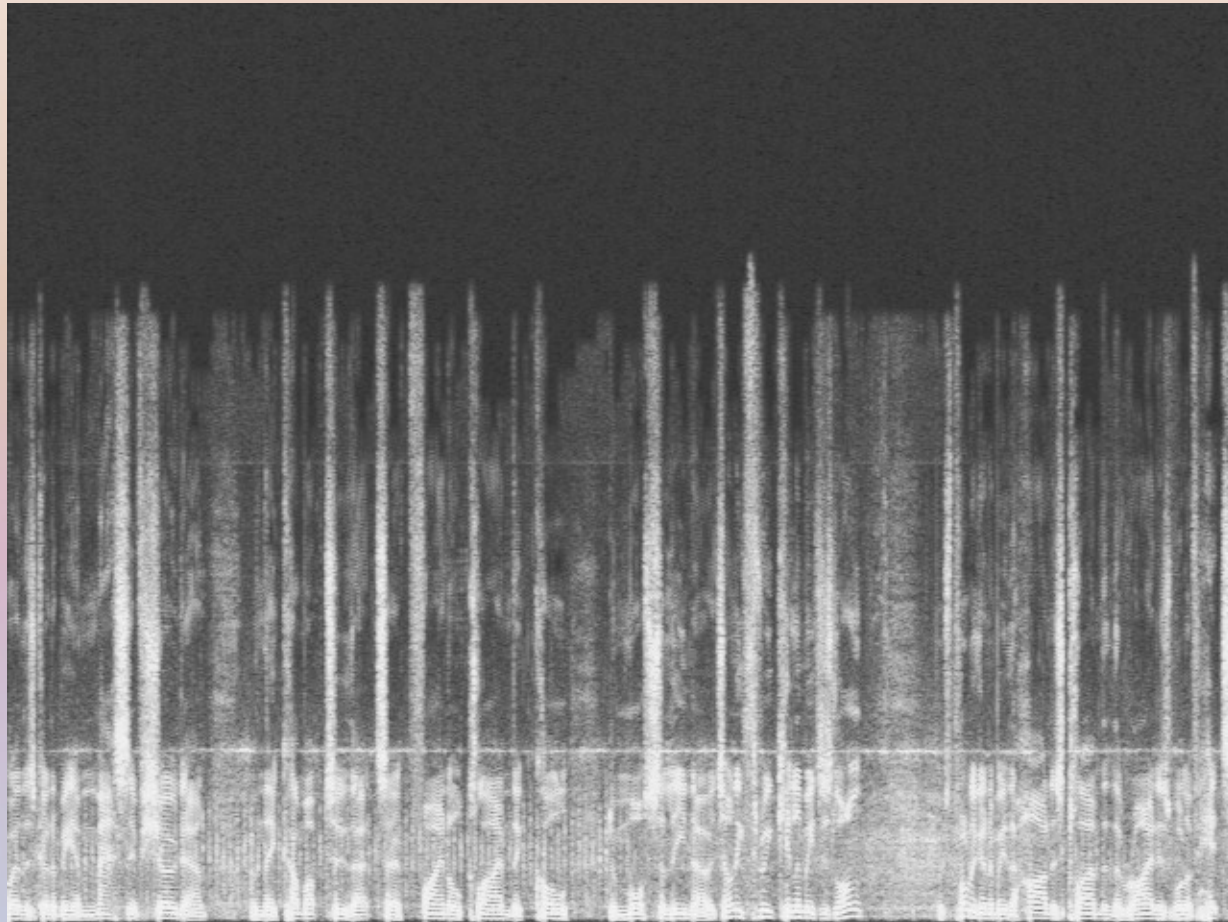
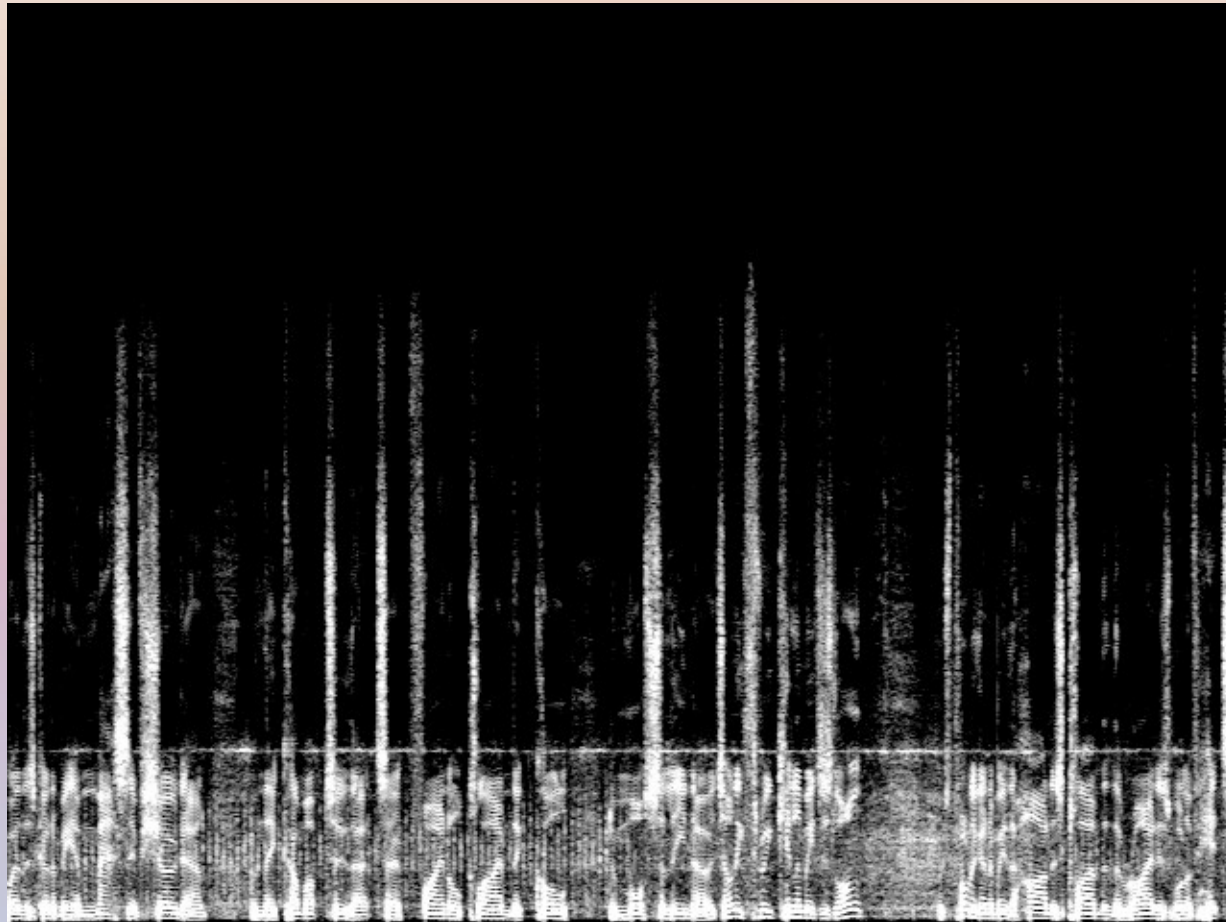# FFT greyscale

Normalised
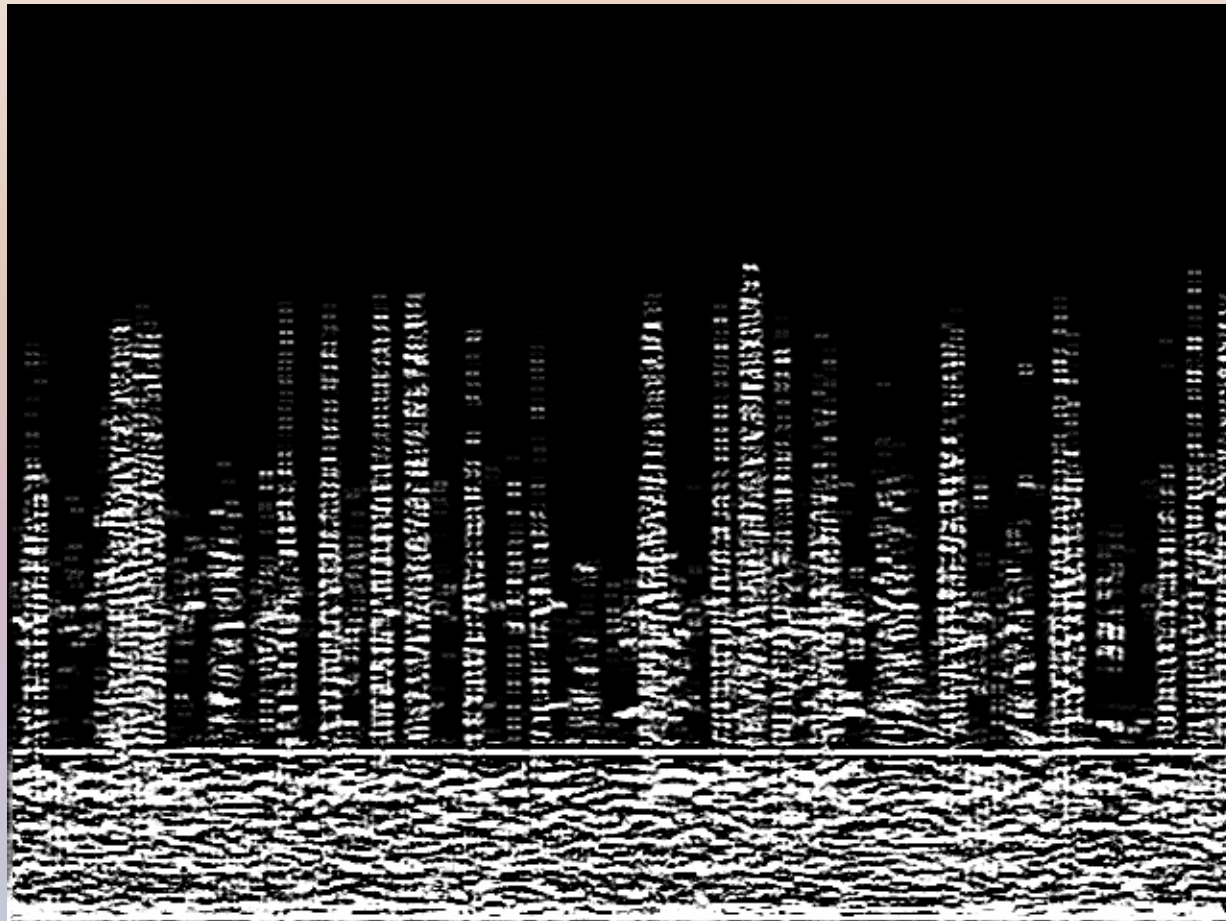
Convolved

Cropped

Original "interesting" FFT PNG

FFT greyscale
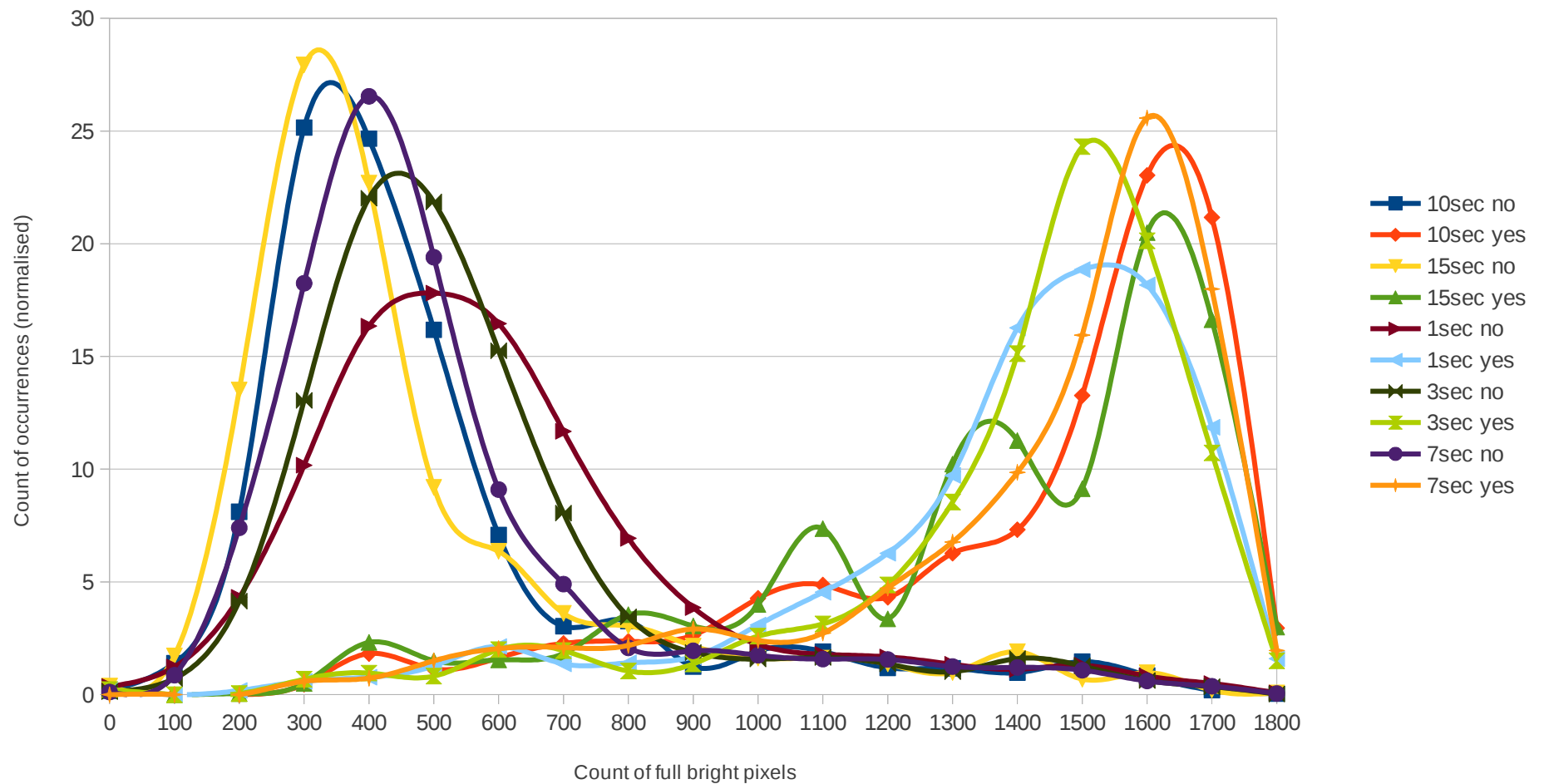
Normalised

Convolved

Cropped

Histogram Comparison

brightness	tone	no tone
0	59	**863**
1	0	9
2	0	4
3	0	7
4	0	6
5	1	2
⋮	⋮	⋮
⋮	⋮	⋮
250	1	2
251	2	2
252	2	1
253	0	2
254	0	2
255	**1712**	390

Fine Tuning Categorisation

Categorisation histogram

Final thoughts

- Still too many shots of cyclists, but not up-close
- Depends heavily on edit technique and audio mix
- mplayer/mencoder are really finicky
- AVI format is really finicky for seeking
- Using image-processing for audio-processing, wtf?

Questions?

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