*************DRAFT*************

Testing C code with Ultibo Bare Metal, Ultibo TFTP and Ultibo Bitmaps

01/25/17

*************DRAFT*************

Goal: This is hopes of improving the speed of computing the JPEG 2000. The RPi2B or RPi3B will run Ultibo Bare Metal.

To transfer images over an Ethernet connection to a RPi2B or RPi3B.

Perform the JPEG 2000 lifting step which is the first step in the JPEG 2000.

The C code which which performs the Lifting step was develop by

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The C code that performs the DWT Lifting Step runs on x86_64 6 core is considerably faster.

```
time ./liftmain lena_rgb_512.png

real	0m0.090s
user	0m0.043s
sys	0m0.009s
```

The C code that performs the DWT Lifting Step runs on the x86_64 dual core and RPi3B is approximately the same.

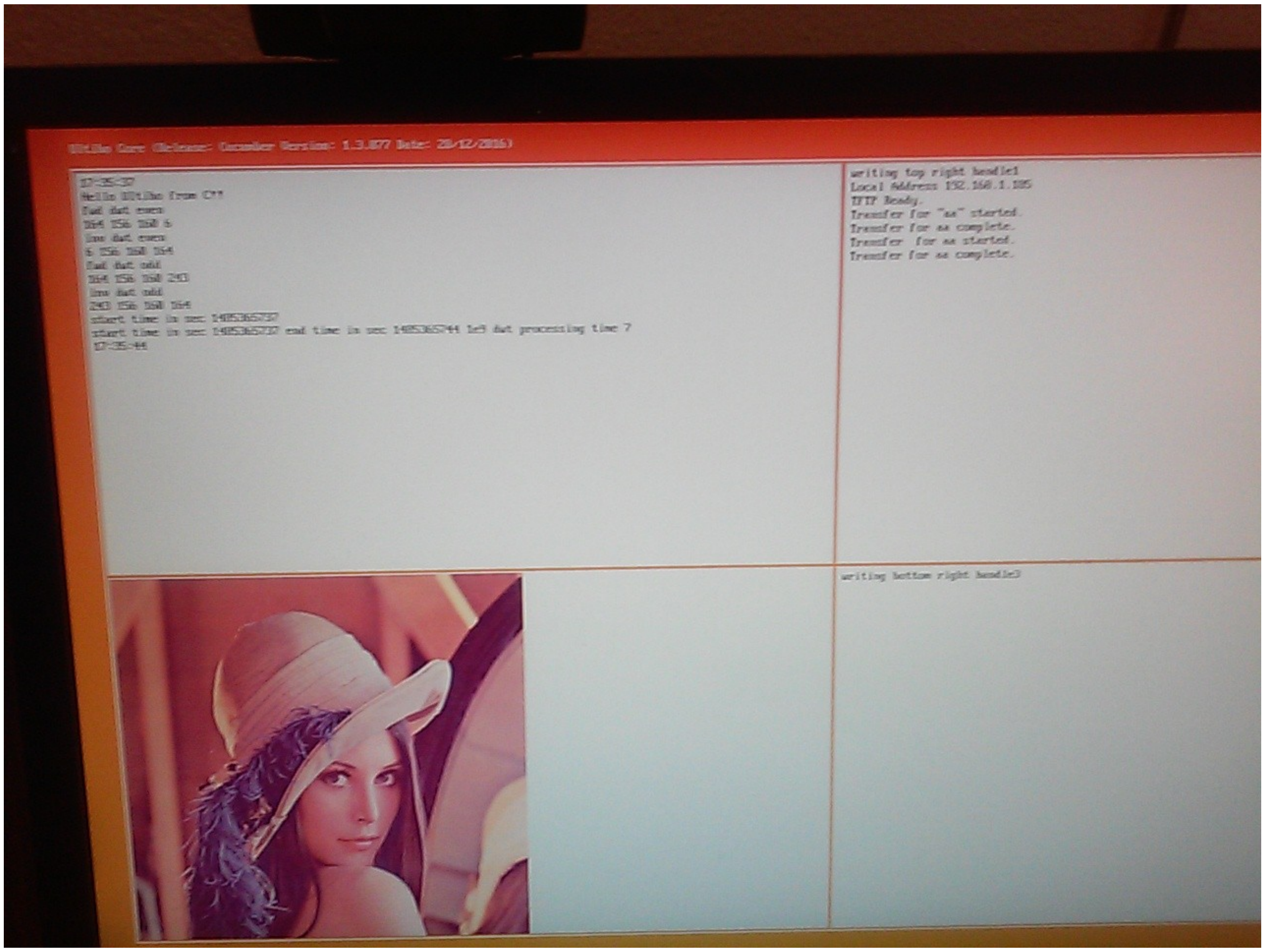
On x86_64 dual core

```
time ./liftmain lena_rgb_512.png

real	0m0.356s
user	0m0.209s
sys	0m0.040s
```

On a RPi3B

```
./ltime ./liftmain lena_rgb_512.png

real	0m0.380s
user	0m0.230s
sys	0m0.010s
```

Status: Several Ultibo examples have been merged into a 4 program which displays a bitmap, calls a C library, and provides a TFTP server.



```
Ultibo Core (Release: Cucumber Version: 1.3.077 Date: 20/12/2016)

17:35:37
Hello Ultibo from C**
fwd dwt even
164 156 160 6
inv dwt even
6 156 160 164
fwd dwt odd
164 156 160 243
inv dwt odd
243 156 160 164
start time in sec 1485365737
start time in sec 1485365737 end time in sec 1485365744 1e9 dwt processing time 7
17:35:44
```

```
writing top right handle1
Local Address 192.168.1.185
TFTP Ready.
Transfer for "aa" started.
Transfer for aa complete.
Transfer  for aa started.
Transfer for aa complete.
```

```
writing bottom right handle3
```

Processing time on Raspbian takes over 10 times more than Ultibo

```
./epochtime
time sec 1485366551
start time in sec 1485366551 end time in sec 1485366624 1e9 dwt processing time 73
```

This only takes 7 sec to perform the 1e9 dwt on Ultibo

Topleft is where the C routine is being called. Bottomleft is a 512 x 512 bitmap
In the file test.c the contents of lifing.c
In the topright is the tftp process.
# ultibo-tftp

A reasonably quick method of transferring files in an Ultibo project.
It uses Trival FTP based on RFC 1350

Approx upload times around 16 secs for kernel7.img of approx 2.2 MB

https://github.com/pjde/ultibo-tftp.git

tftp 192.168.1.185tftp> binary

```
tftp> put grn-out.32t aa
Sent 1048576 bytes in 5.0 seconds    1.67MBits/s
tftp> get aa bb
Received 1048580 bytes in 4.1 seconds        2.04MBits/s
tftp> quit
```

```
extern  void    singlelift(int rb, int w, int * const ibuf, int * const obuf);
extern  void    ilift(int rb, int w, int * const ibuf, int * const obuf);
extern  void    lifting(int w, int *ibuf, int *tmpbuf);
```

This is needed to add the fpc compiler to the PATH.

```
export PATH=/home/pi/ultibo/core/fpc/bin:$PATH
echo $PATH
/
home/pi/ultibo/core/fpc/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/local/games:/u
sr/games
```

```
arm-none-eabi-gcc -O2 -mabi=aapcs -marm -march=armv7-a -mfpu=vfpv3-d16 -mfloat-abi=hard -c
test.c
```

```
arm-none-eabi-ar rcs libtest.a test.o
```

```
fpc -vi -B -Tultibo -Parm -CpARMV7A -WpRPI2B @/home/pi/ultibo/core/fpc/bin/rpi2.cfg -O2
LibCTestRPi2.lpr
```

./build_liftmain.sh compiles lifting.c & liftmain.c --> liftmain

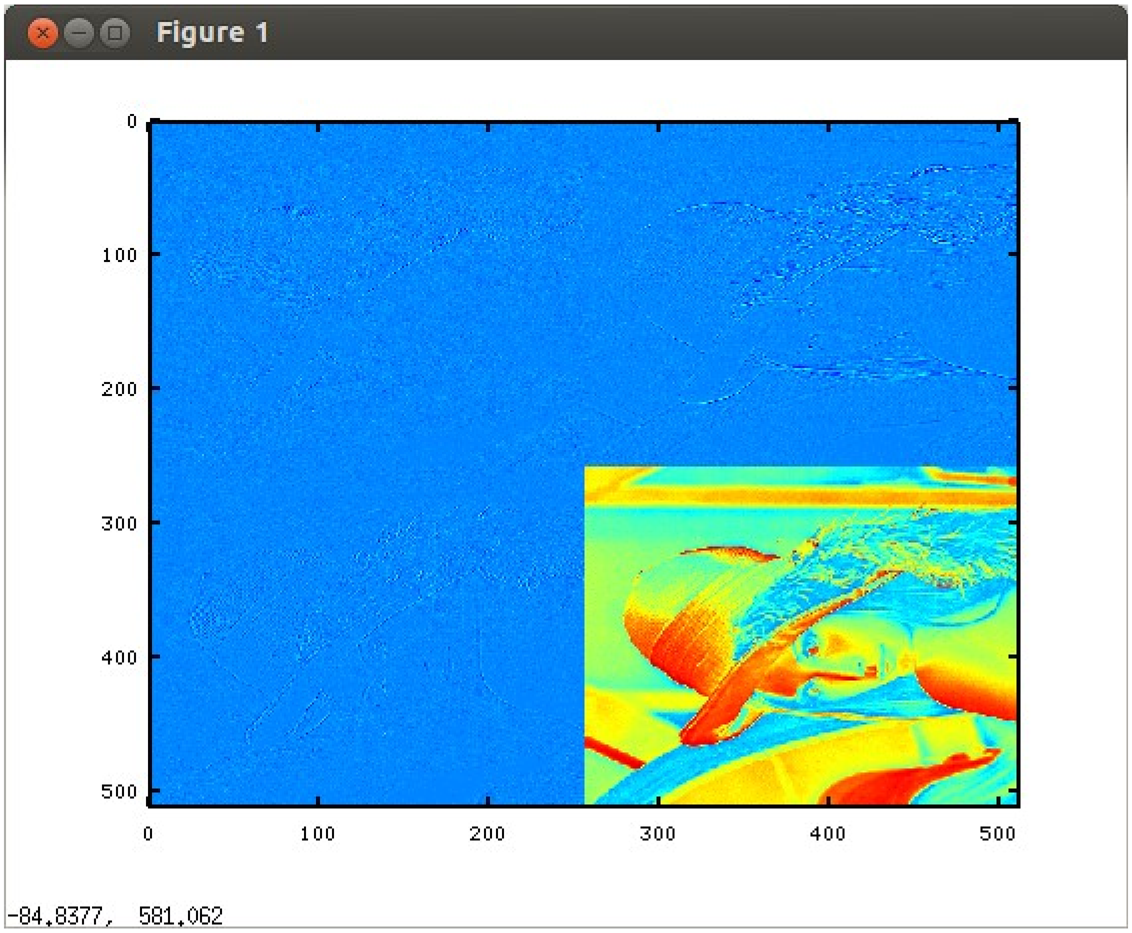
```
iftmain lena_rgb_512.png
        red-out.32t
```

line 101 lifting.c   const int   LVLS = 1; performs 1 level forward DWT

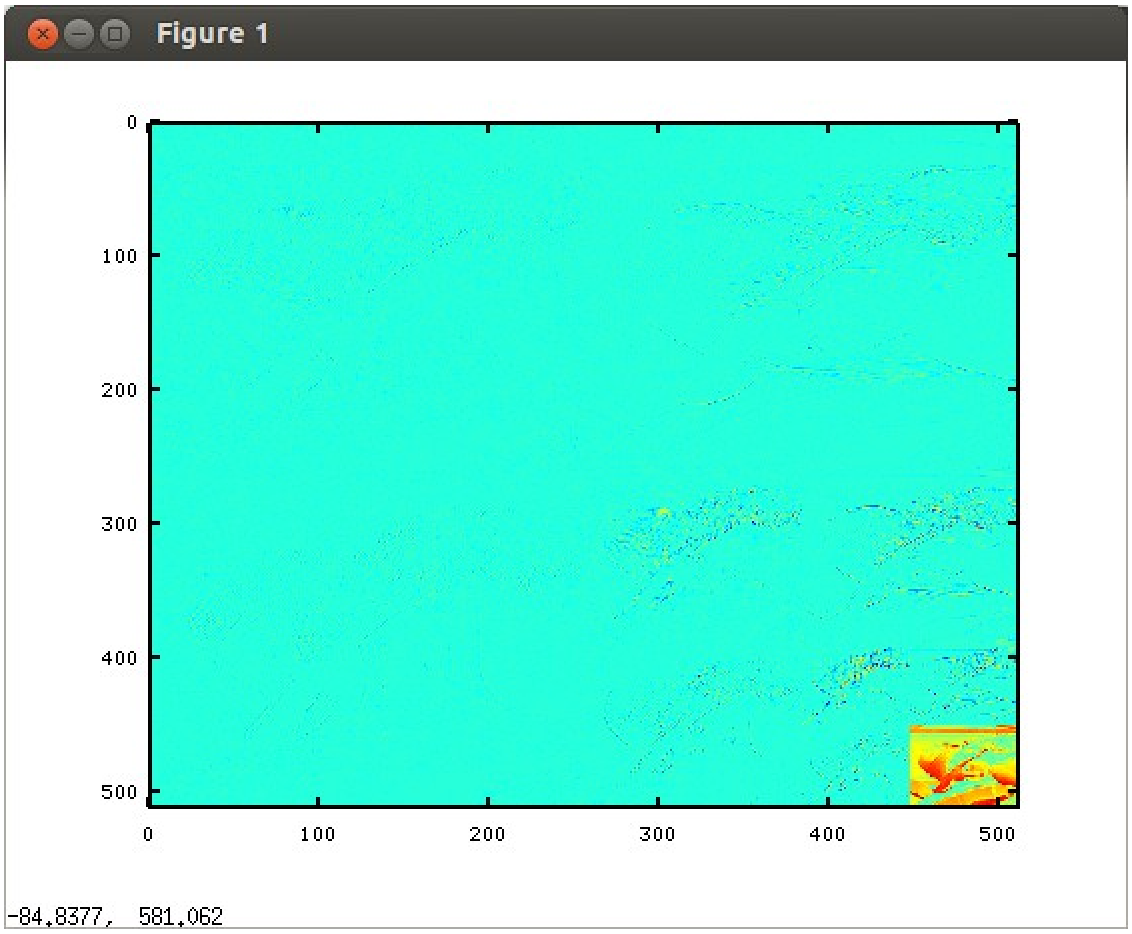
lines 230-246 in lifting.c when commented does not perform the inverse DWT.

```
/*
        for(lvl=(LVLS-1); lvl>=0; lvl--) {
                int     offset;

                w <<= 1;

                if (lvl)
                        offset = ov[lvl-1];
                else
                        offset = 0;
                ip = &ibuf[offset];
```

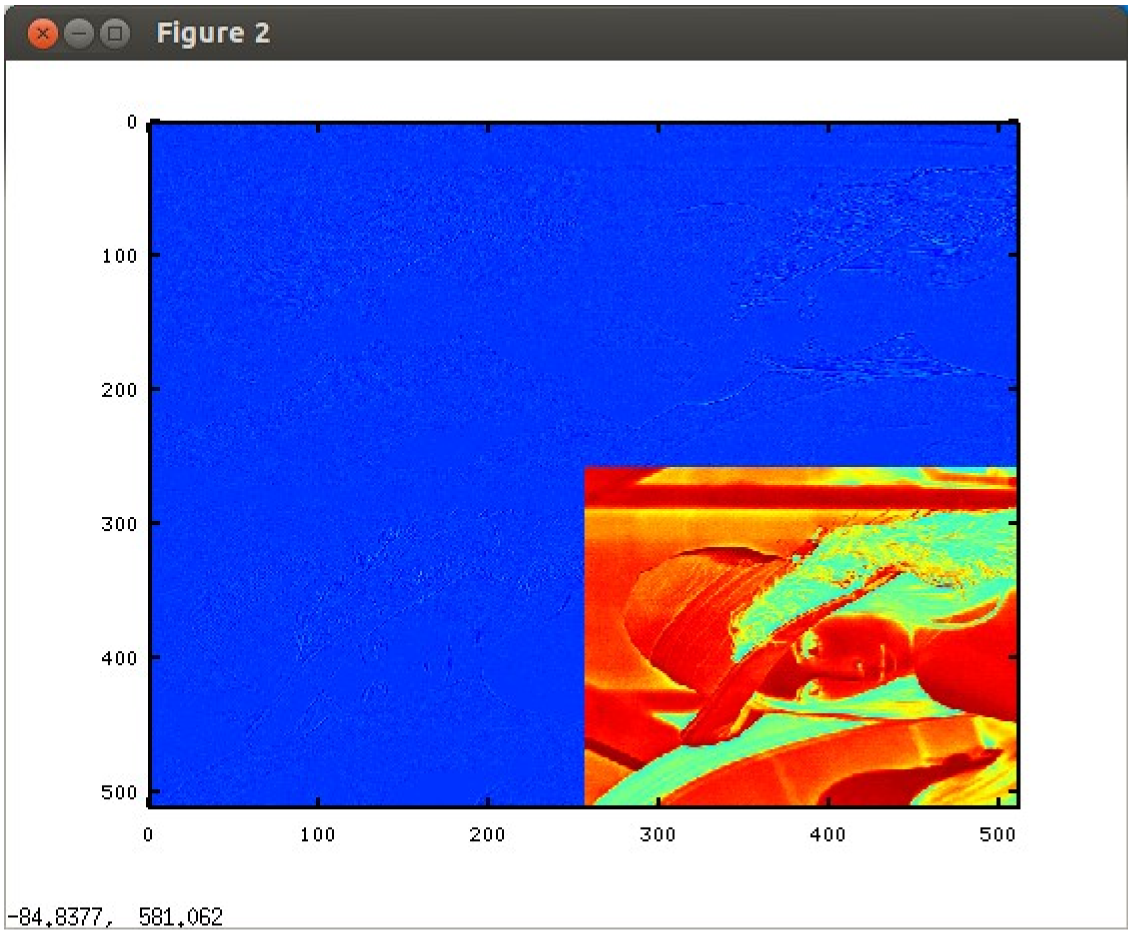
```
            tp = &tmpbuf[offset];

            ilift(rb, w, ip, tp);
            ilift(rb, w, tp, ip);
    }
    */
```



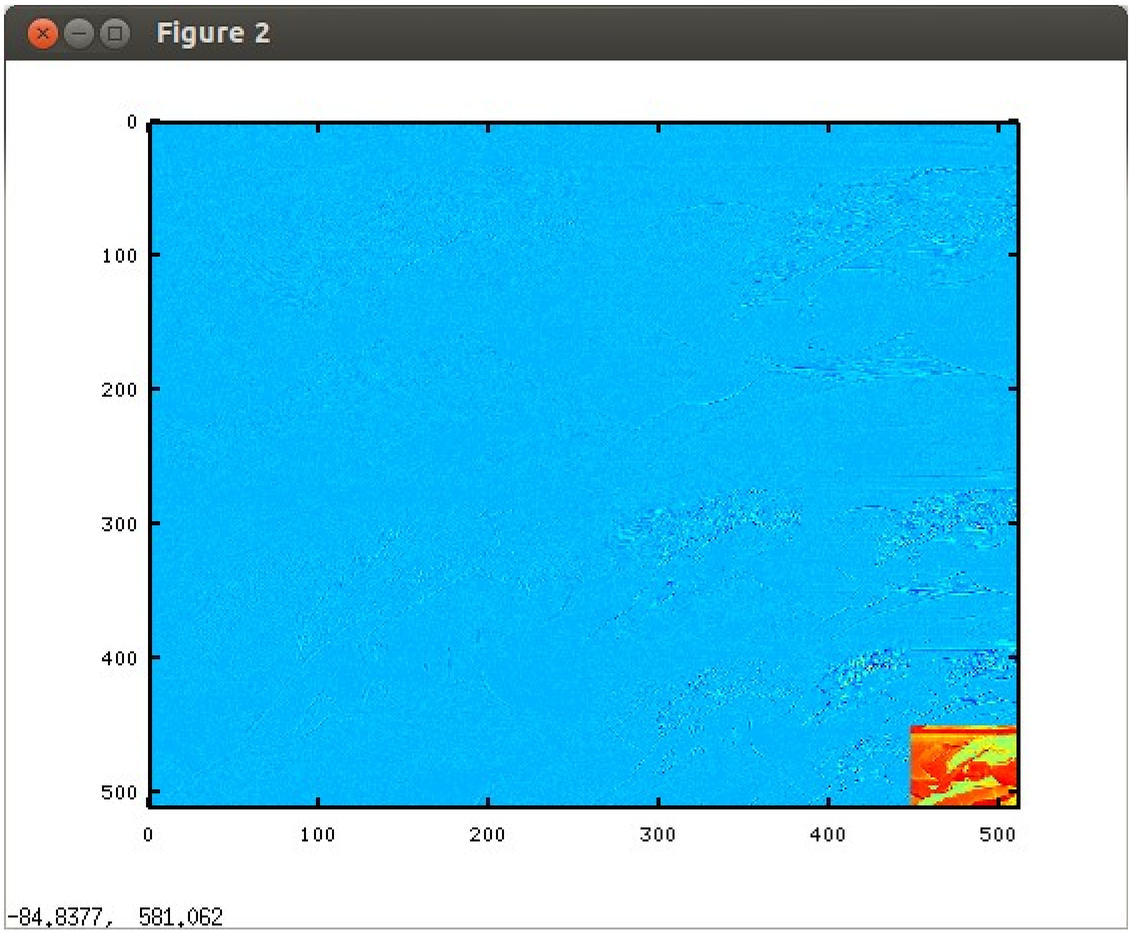
The image above is 1 level forward DWT red subband
The file red-out.32t



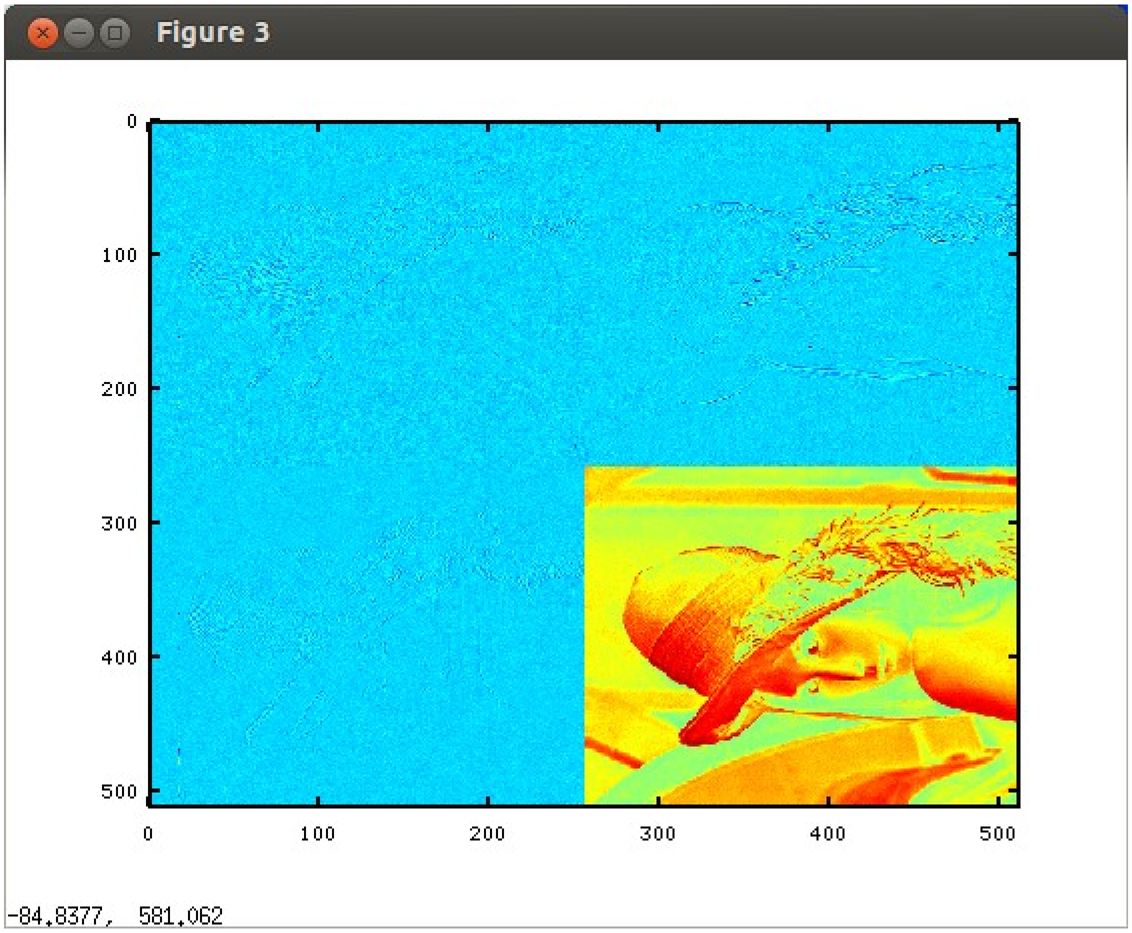
The image above is 3 levels forward DWT red subband
The file red-out.32t



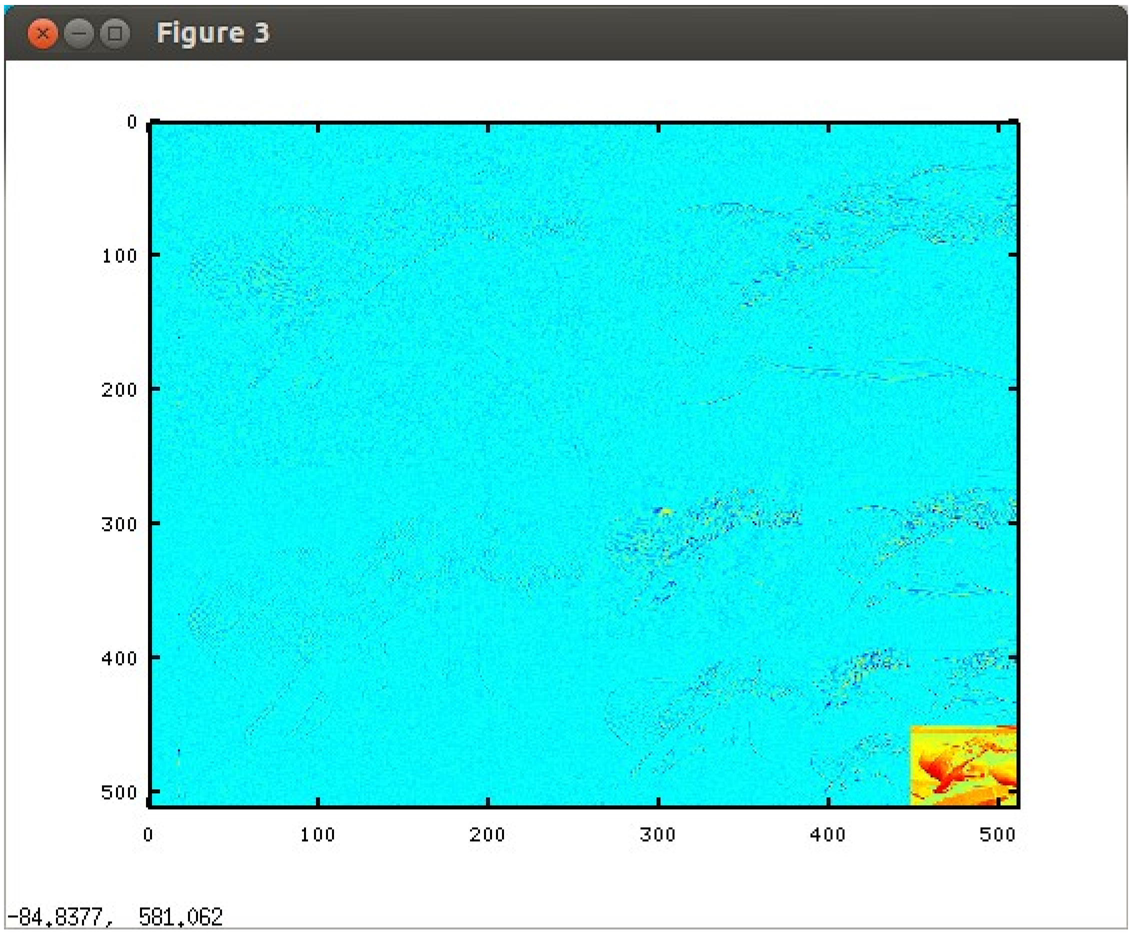
The image above is 1 level forward DWT grn subband
The file grn-out.32t



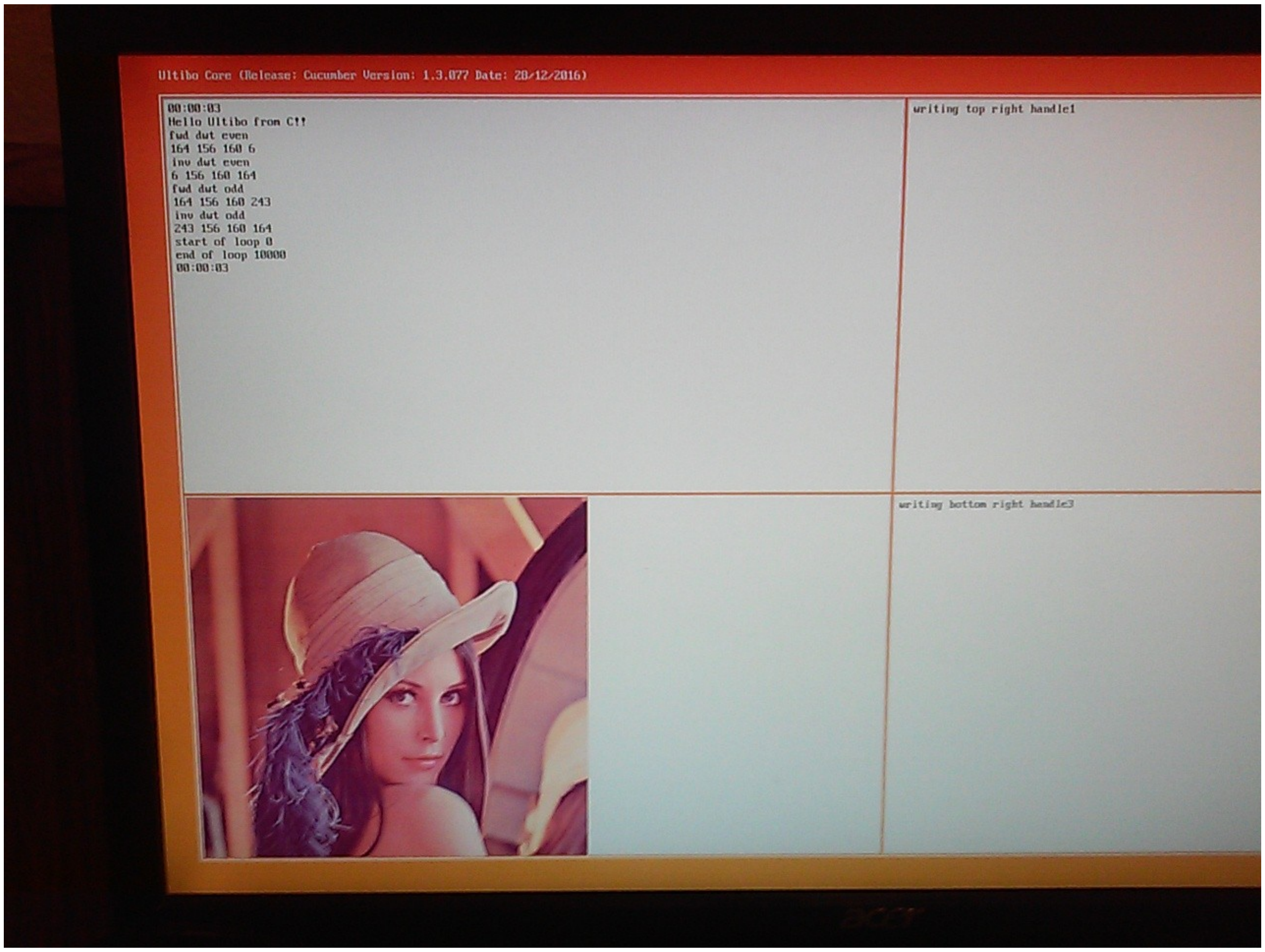
The image above is 3 levels forward DWT grn subband
The file grn-out.32t



The image above is 1 level forward DWT blu subband
The file blu-out.32t



The image above is 3 levels forward DWT blu subband
The file blu-out.32t



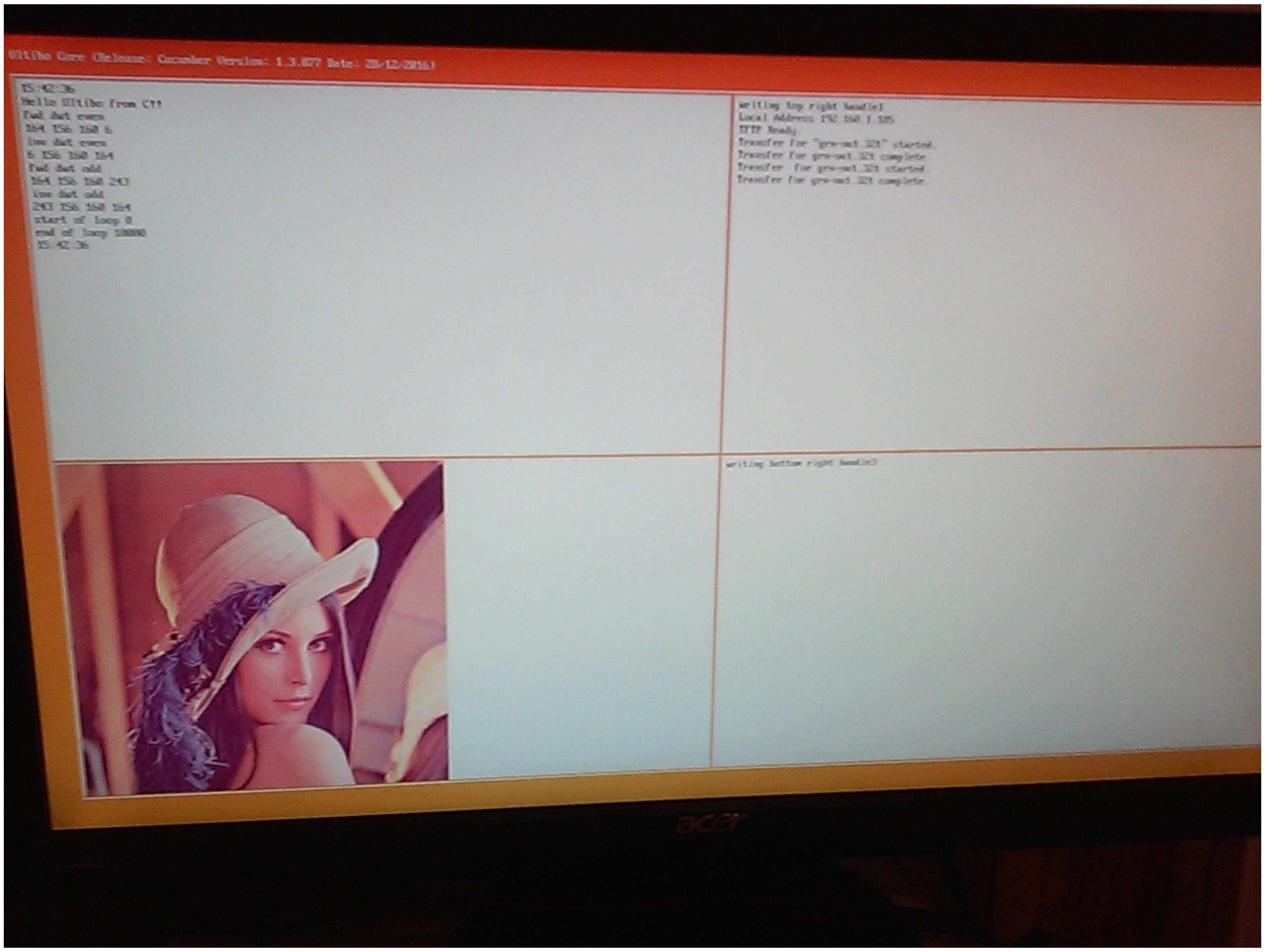
```
Ultibo Core (Release: Cucumber Version: 1.3.077 Date: 28/12/2016)
```

```
00:00:03
Hello Ultibo from C!!
fwd dwt even
164 156 160 6
inv dwt even
6 156 160 164
fwd dwt odd
164 156 160 243
inv dwt odd
243 156 160 164
start of loop 0
end of loop 10000
00:00:03
```

```
writing top right handle1
```

```
writing bottom right handle3
```

The above image is the running on RPi3B as compiled for RPi2B on 01/23/17.



```
Ultibo Core (Release: Cucumber Version: 1.3.077 Date: 28/12/2016)
```

```
15:42:36
Hello Ultibo from C!!
fwd dwt even
164 156 160 6
inv dwt even
6 156 160 164
fwd dwt odd
164 156 160 243
inv dwt odd
243 156 160 164
start of loop 0
end of loop 10000
15:42:36
```

```
writing top right handle1
Local Address 192.168.1.105
TFTP Ready.
Transfer for "grw-out.32t" started.
Transfer for grw-out.32t complete.
Transfer  for grw-out.32t started.
Transfer for grw-out.32t complete.
```

```
writing bottom right handle3
```