Subject: Subpixel rendering
Posted by mirek on Sat, 21 Feb 2009 16:24:35 GMT
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Today I have spend some time trying to implement subpixel rendering (that is the technique using individual RGB subpixels to enhance horizontal resolution).

I am not quite sure whether it is worth it:)

See enclosed pictures and tell me if you see the difference, please:)

(One is using normal aliasing, second employs subpixel rendering).

Mirek

File Attachments

1) normal.PNG, downloaded 1513 times

QTF

QTF is the native format of Ultimate++ rich texts (formatted texts).

It is byte oriented format. Bytes with values 2-31 are ignored. Other are interpreted as characters or formatting commands.

Letters (a-zA-Z), numbers (0-9), space (32) and characters

. , ; ! ? % ( ) / < > #

and bytes greater than 127 are guaranteed to be never used as command characters (not even in future versions of QTF). Other characters should be prefixed with escape character ` (reverse apostrophe). Group of characters can be escaped using byte 1. Example:

```
"a[x][* bold]"
```

Byte 0 represents the end of input sequence.

Dimension units of QTF are dots - one dot is defined as 1/600 of inch.

Colors are described as either number 0-9, with meaning

0	1	2	3	4	5	6	7	8	9
Black	LtGray	White	Red	Green	Blue	LtRed	WhiteGray	LtCyan	Yellow

Subject: Re: Subpixel rendering

Posted by mirek on Sat, 21 Feb 2009 16:24:57 GMT
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File Attachments

1) subpixel.PNG, downloaded 1393 times

QTF

QTF is the native format of Ultimate++ rich texts (formatted texts).

It is byte oriented format. Bytes with values 2-31 are ignored. Other are interpreted as characters or formatting commands.

Letters (a-zA-Z), numbers (0-9), space (32) and characters

. , ; ! ? % ( ) / < > #

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Subject: Re: Subpixel rendering
Posted by chickenk on Sat, 21 Feb 2009 17:48:52 GMT
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Are you following Maxim Shemanarev's advices about RGB subpixel rendering for fonts (very interesting article, I give the link for interested people: http://antigrain.com/research/font_rasterization/index.html) or another technique of yours?

In his examples, it seems obvious that the result is much more interesting with RGB subpixel rendering, when done correctly. But indeed there is not so much difference between your two pictures. Can you show us a sample with a smaller scale factor? Maybe small fonts could make the difference more obvious. If not, then maybe it's not worth it... Is it much slower ?

Thanks for all your work on Painter.

regards,
Lionel

Subject: Re: Subpixel rendering
Posted by mirek on Sat, 21 Feb 2009 18:21:05 GMT
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chickenk wrote on Sat, 21 February 2009 12:48Are you following Maxim Shemanarev's advices about RGB subpixel rendering for fonts (very interesting article, I give the link for interested people: http://antigrain.com/research/font_rasterization/index.html) or another technique of yours?

Well, I have seen that. One thing I do not really agree about is discarding the hinting information, but I have used links there to get info about low-pass-filter etc...

Quote:
In his examples, it seems obvious that the result is much more interesting with RGB subpixel rendering, when done correctly.
But indeed there is not so much difference between your two pictures.

Actually, if you download Maxim's demo of subpixel rendering, there is not so much difference either.

Also, very likely, arial font is not the one most useful here.

Quote:
Can you show us a sample with a smaller scale factor? Maybe small fonts could make the difference more obvious. If not, then maybe it's not worth it... Is it much slower ?

Well, look at "White" text in the example. IMO there is some visible difference...

In any case, subpixel rendering seems to add about 100 lines to Painter, something we can easily afford as option.

BTW, Painter will be the single software renderer to support subpixel rendering for non-text shapes (cairo only does it for texts, AGG does not really seem to support subpixel rendering).

Mirek

Subject: Re: Subpixel rendering
Posted by kodos on Sat, 21 Feb 2009 19:27:20 GMT

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Hi,

I think the text looks quite a bit better with subpixel rendering, but it seems as if the vertical lines of the bottom table are "colored" in the subpixel picture. That doesn't look so good. I don't know if this is an error in your implementation or a side effect of the used algorithm.

Subject: Re: Subpixel rendering
Posted by mirek on Sat, 21 Feb 2009 19:56:08 GMT
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kodos wrote on Sat, 21 February 2009 14:27Hi,

I think the text looks quite a bit better with subpixel rendering, but it seems as if the vertical lines of the bottom table are "colored" in the subpixel picture. That doesn't look so good. I don't know if this is an error in your implementation or a side effect of the used algorithm.

Well, that IMO is unavoidable. I believe they look OK if seen from distance - the computed colors should blend into gray.

IMO, you are going to see such artifacts in any subpixel rendering system. It is just that the text usually is not thin vertical line....

OTOH, it is still possible I have error somewhere

Mirek

Subject: Re: Subpixel rendering
Posted by kodos on Sat, 21 Feb 2009 21:37:58 GMT
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If I had to choose between the 2 I would definitely choose the subpixel picture, and it really looks OK from a "normal" distance. I just thought there could be a problem because the line left from the text "white" is blue and the pixels left and right from that line are nearly perfect white and I thought that could be a problem.

But it really looks great.

Subject: Re: Subpixel rendering
Posted by mirek on Sat, 21 Feb 2009 22:45:54 GMT
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kodos wrote on Sat, 21 February 2009 14:27Hi,

I think the text looks quite a bit better with subpixel rendering, but it seems as if the vertical lines of the bottom table are "colored" in the subpixel picture. That doesn't look so good. I don't know if this is an error in your implementation or a side effect of the used algorithm.

Well, after rechecking and rethinking, I think there really might be a bug in the code....

Mirek

Subject: Re: Subpixel rendering
Posted by mirek on Sun, 22 Feb 2009 17:52:51 GMT
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OK, after fixing the bug and optimizing:

- it really shows, especially with italics and thinner fonts
- it can be up to 60% slower (in 'Lion' test) than normal mode

I am not posting more screenshots, just test PainterExamples from svn...

Anyway, to make the long story short, we have now subpixel rendering in Painter, with modest price of 2KB of code...

Mirek

Subject: Re: Subpixel rendering
Posted by kodos on Sun, 22 Feb 2009 18:17:02 GMT
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Nice

And I think the 60% are OK for subpixel rendering. For text it is well worth it.

Subject: Re: Subpixel rendering
Posted by mirek on Sun, 22 Feb 2009 19:26:56 GMT
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kodos wrote on Sun, 22 February 2009 13:17Nice

And I think the 60% are OK for subpixel rendering. For text it is well worth it.

Interestingly, for text it is much less (~10%). I think that it is caused by fact that text spends a lot of time parsing glyph definition and then approximating quadratic curves (which is same for normal mode). I guess that in future, we might want to introduce some optimizations for text rendering.

OTOH, it quite depends on Painter usage scenarios.

Lion test is mostly about filling polygons, no expensive glyph parsing, no quadratic curves.

Mirek

Subject: Re: Subpixel rendering
Posted by mr_ped on Mon, 23 Feb 2009 07:39:14 GMT
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Impressive work, thank you Mirek.

Subject: Re: Subpixel rendering
Posted by cbpporter on Mon, 23 Feb 2009 09:24:11 GMT
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I looked at the screenshots on several different LCD, and on average office LCD, they look almost identical. Upon more closer inspection, the second looks slightly better, but more blurry. On a more high quality and resolution display, the difference is more pronounced, and the second looks better, nut not universally. So I guess I vote for the second.

But were the scrnshots taken under Windows? Because they both look horrible and are hard to read when compared to simple native Windows rendered text (ClearType) . Maybe results are better under Linux, where antialised fonts are generally ugly.

Subject: Re: Subpixel rendering
Posted by mirek on Mon, 23 Feb 2009 09:54:30 GMT
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cbpporter wrote on Mon, 23 February 2009 04:24I looked at the screenshots on several different LCD, and on average office LCD, they look almost identical. Upon more closer inspection, the second looks slightly better, but more blurry. On a more high quality and resolution display, the difference is more pronounced, and the second looks better, nut not universally. So I guess I vote for the second.

But were the scrnshots taken under Windows? Because they both look horrible and are hard to read when compared to simple native Windows rendered text (ClearType) . Maybe results are better under Linux, where antialised fonts are generally ugly.

There were some bugfixes on the way, better check PainterExample from svn...

But of course, it is not the same thing as Cleartype. Generally, Painter will always prefer subpixel

accuracy, that in some cases might lead to blurring....

Mirek

Subject: Re: Subpixel rendering
Posted by mirek on Mon, 23 Feb 2009 13:00:11 GMT
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luzr wrote on Sun, 22 February 2009 12:52
- it can be up to 60% slower (in 'Lion' test) than normal mode

Well, after 6 hours of optimizing the crap out of it and wasting 500 more bytes of really wicked code, it is now only 40% slower in Lion test...

Mirek

Subject: Re: Subpixel rendering
Posted by unodgs on Mon, 23 Feb 2009 14:28:05 GMT
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mr_ped wrote on Mon, 23 February 2009 02:39Impressive work, thank you Mirek.
Exactely! Can't wait for chart controls based on painter.

Subject: Re: Subpixel rendering
Posted by kodos on Mon, 23 Feb 2009 15:23:26 GMT
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I played a bit with the demo and found another small problem. If you choose Subpixel AA and you play around with the opacity slider there are some artifacts. Best seen in the RichText example.

Subject: Re: Subpixel rendering
Posted by mirek on Mon, 23 Feb 2009 15:40:20 GMT
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kodos wrote on Mon, 23 February 2009 10:23I played a bit with the demo and found another small problem. If you choose Subpixel AA and you play around with the opacity slider there are some artifacts. Best seen in the RichText example.

Already fixed. At least I hope

Mirek

Subject: Re: Subpixel rendering
Posted by kodos on Mon, 23 Feb 2009 18:18:20 GMT
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yes

The google svn mirror was probably not fast enough ^^