

Watermarking StirMark Benchmarking

DS-CDMA

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DS-CDMA: Concept

RP_0	: -1 1 1 -1 -1 1 -1 -1 1 1 -1	b_0	: 0	\rightarrow	$+RP_0$: -1 1 1 -1 -1 1 -1 -1 1 1 -1
RP_1	: 1 1 -1 -1 1 -1 -1 1 1 1 -1	b_1	: 0	\rightarrow	$+RP_1$: 1 1 -1 -1 1 -1 -1 1 1 1 -1
RP_2	: 1 -1 -1 1 -1 -1 1 1 -1 1 -1	b_2	: 1	\rightarrow	$-RP_2$: -1 1 1 -1 1 1 -1 -1 1 -1 1
RP_3	: -1 -1 1 -1 -1 1 1 -1 1 -1 -1	b_3	: 1	\rightarrow	$-RP_3$: 1 1 -1 1 1 -1 -1 1 -1 1 1
RP_4	: -1 1 -1 -1 1 1 -1 1 -1 -1 1	b_4	: 0	\rightarrow	$+RP_4$: -1 1 -1 -1 1 1 -1 1 -1 -1 1
RP_5	: 1 -1 -1 1 1 -1 1 -1 -1 1 1	b_5	: 1	\rightarrow	$-RP_5$: -1 1 1 -1 -1 1 -1 1 1 -1 -1
RP_6	: -1 -1 1 1 -1 1 -1 -1 1 1 1	b_6	: 0	\rightarrow	$+RP_6$: <u>-1 -1 1 1 -1 1 -1 -1 1 1 1</u> +
					W	: -3 5 1 -3 1 3 -7 1 3 -1 3

W	:	-3	5	1	-3	1	3	-7	1	3	-1	3	
I	:	<u>98</u>	<u>98</u>	<u>97</u>	<u>98</u>	<u>97</u>	<u>96</u>	<u>97</u>	<u>96</u>	<u>95</u>	<u>94</u>	<u>94</u>	+
I_W	:	95	103	98	95	98	99	90	97	98	93	97	

$$E[(RP_0 - E[RP_0]) \cdot (I_W - E[I_W])] = +15.6 \rightarrow b_0 = 0$$

$$E[(RP_1 - E[RP_1]) \cdot (I_W - E[I_W])] = +16.4 \rightarrow b_1 = 0$$

$$E[(RP_2 - E[RP_2]) \cdot (I_W - E[I_W])] = -26.4 \rightarrow b_2 = 1$$

$$E[(RP_3 - E[RP_3]) \cdot (I_W - E[I_W])] = -3.1 \rightarrow b_3 = 1$$

$$E[(RP_4 - E[RP_4]) \cdot (I_W - E[I_W])] = +21.6 \rightarrow b_4 = 0$$

$$E[(RP_5 - E[RP_5]) \cdot (I_W - E[I_W])] = -23.6 \rightarrow b_5 = 1$$

$$E[(RP_6 - E[RP_6]) \cdot (I_W - E[I_W])] = +0.4 \rightarrow b_6 = 0$$

DS-CDMA: Doelstelling

- Embedding en detectie programmeren
- PSNR test
- Robuustheid tegen aanvallen testen

DS-CDMA: Resultaat



Original



Gain = 1



Gain = 10

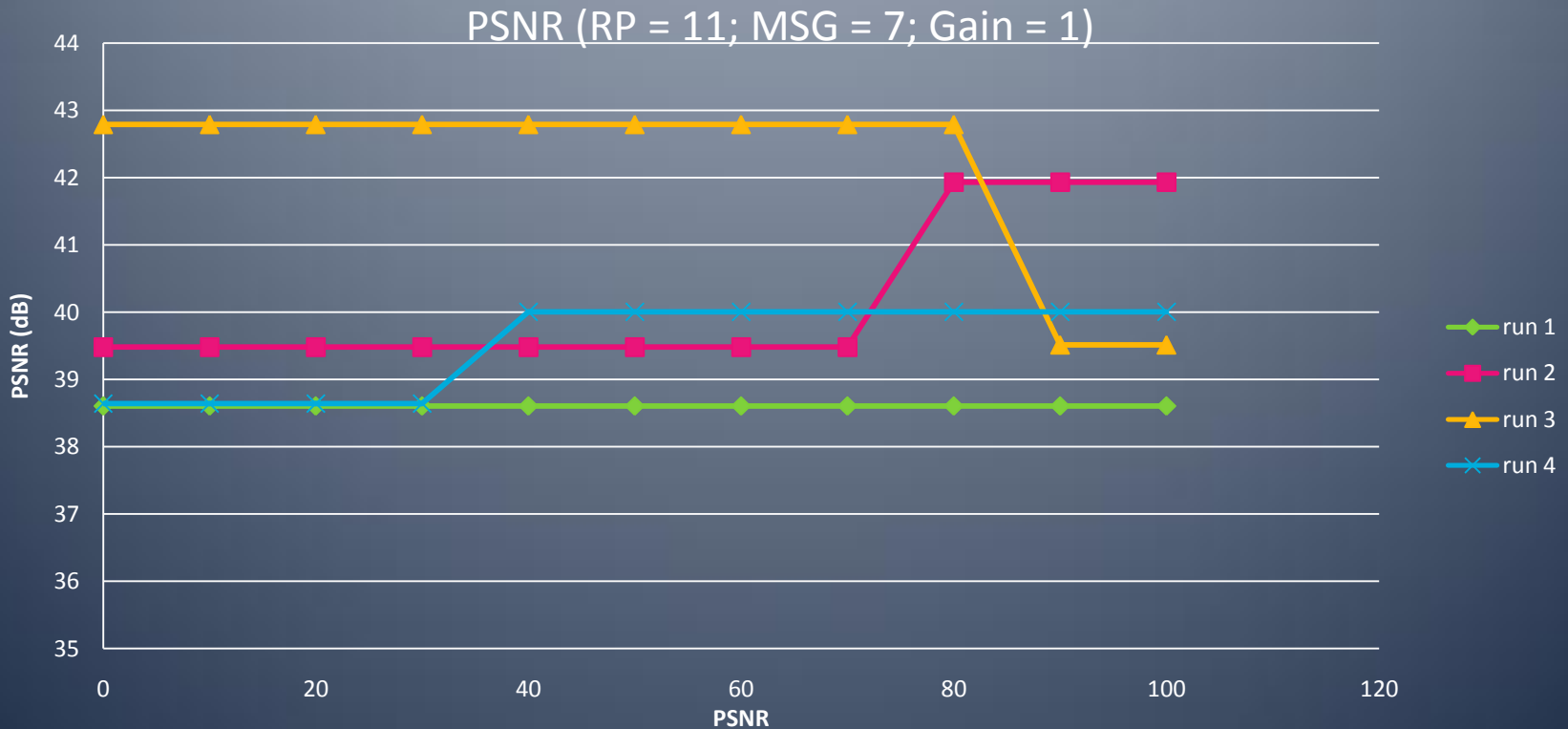
DS-CDMA: Resultaat

- Onbetrouwbare detectie -> afronding?
- Detectie is afhankelijk van nSeed

Orig	0	0	1	1	0	1
Run 1	0	0	1	0	0	1
Run 2	1	0	0	1	0	1
Run 3	0	0	1	1	0	0

DS-CDMA: Resultaat

- PSNR meting niet consequent



Werkwijze

- Watermerk van 200 pixels lang
- Message length is 30

```
for (int i = 0; i < nPixels; i++)  
{  
    out_pimgTarget->pgData[i] =  
        Clip(in_imgOriginal.pgData[i] + W[i%200]);  
}
```

- Test correlatie

Correlatie

Formule uit Stirmark zelf is niet juist, dus verandert naar de formule uit de paper

$$R_{I'_W(x,y)W(x,y)} = \frac{1}{N} \sum_{i=1}^N I'_{W_i}(x,y)W_i(x,y)$$

Problemen

- `RAND_MAX/2`
- Correlatie negatief
- Waarde van correlatie veranderde plots
 - `nSeed`

```
uint nSeed = 1;
for(uint i = 0; i < inout_pPars->in_nKeyLength; i++)
    if (inout_pPars->in_pszKey[i] == '1')
        nSeed += 1 << i;
srand(nSeed);
```

DS-CDMA: Concept

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RP_1	: 1 1 -1 -1 1 -1 -1 1 1 1 -1	b_1	: 0	\rightarrow	$+RP_1$: 1 1 -1 -1 1 -1 -1 1 1 1 -1
RP_2	: 1 -1 -1 1 -1 -1 1 1 -1 1 -1	b_2	: 1	\rightarrow	$-RP_2$: -1 1 1 -1 1 1 -1 -1 1 -1 1
RP_3	: -1 -1 1 -1 -1 1 1 -1 1 -1 -1	b_3	: 1	\rightarrow	$-RP_3$: 1 1 -1 1 1 -1 -1 1 -1 1 1
RP_4	: -1 1 -1 -1 1 1 -1 1 -1 -1 1	b_4	: 0	\rightarrow	$+RP_4$: -1 1 -1 -1 1 1 -1 1 -1 -1 1
RP_5	: 1 -1 -1 1 1 -1 1 -1 -1 1 1	b_5	: 1	\rightarrow	$-RP_5$: -1 1 1 -1 -1 1 -1 1 1 -1 -1
RP_6	: -1 -1 1 1 -1 1 -1 -1 1 1 1	b_6	: 0	\rightarrow	$+RP_6$: <u>-1 -1 1 1 -1 1 -1 -1 1 1 1</u> +
					W	: -3 5 1 -3 1 3 -7 1 3 -1 3

W	:	-3	5	1	-3	1	3	-7	1	3	-1	3	
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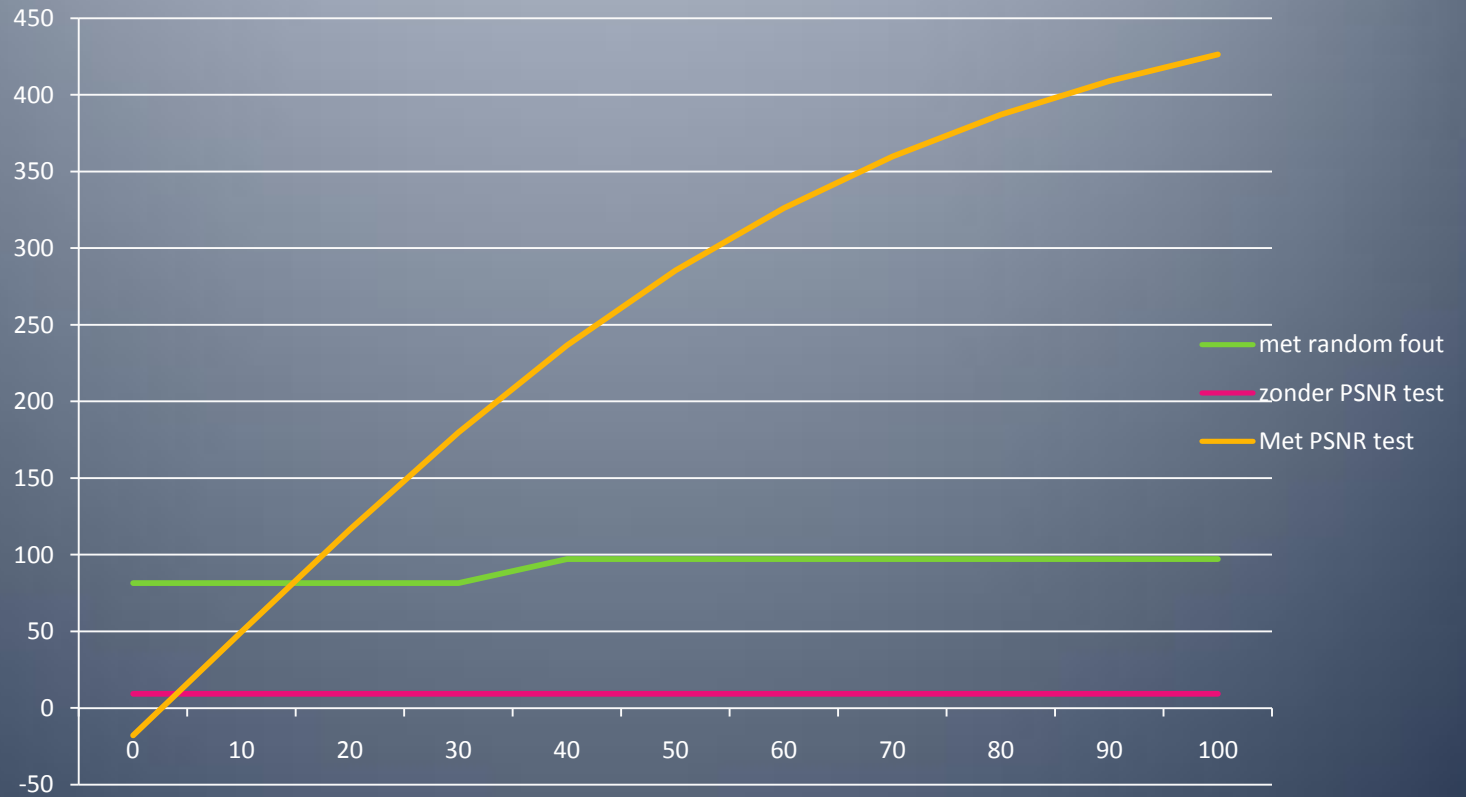
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Resultaten



DS-CDMA

- Geen voorspelbaar gedrag
 - Fout algoritme
 - Fout compiler -> afrondingen?
=> Fout van random generator
- Geen praktisch bewijs

DS-CDMA

- Bedankt voor uw aandacht!