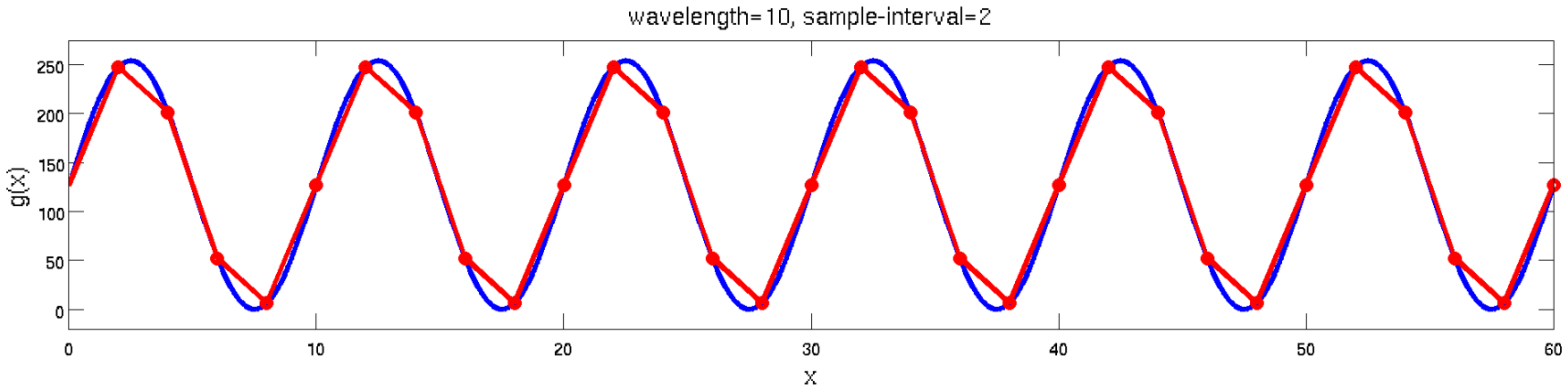
Slide 8

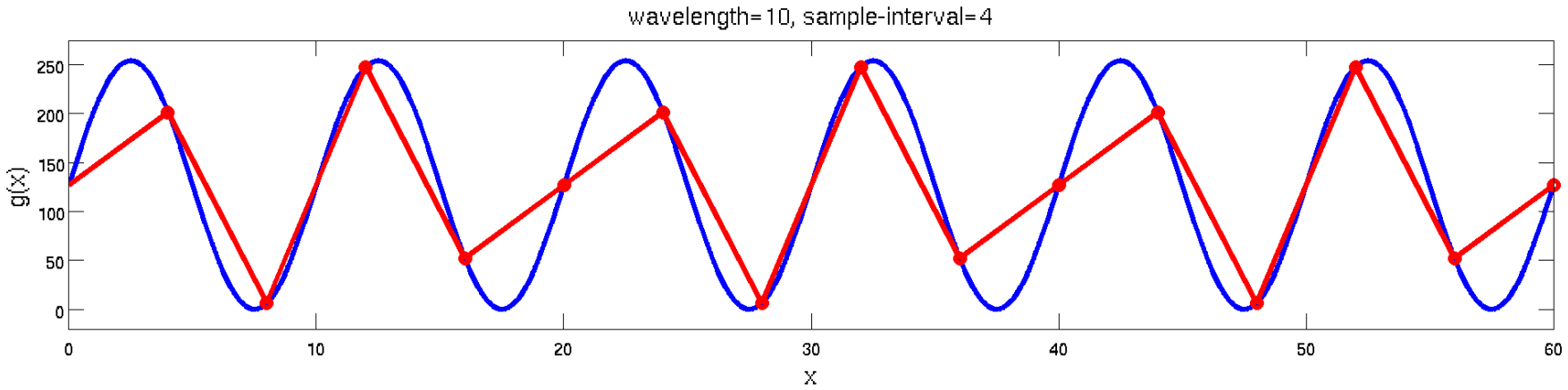
Sampling: Moiré Patterns cont.

- 1D-example of Moiré patterns:



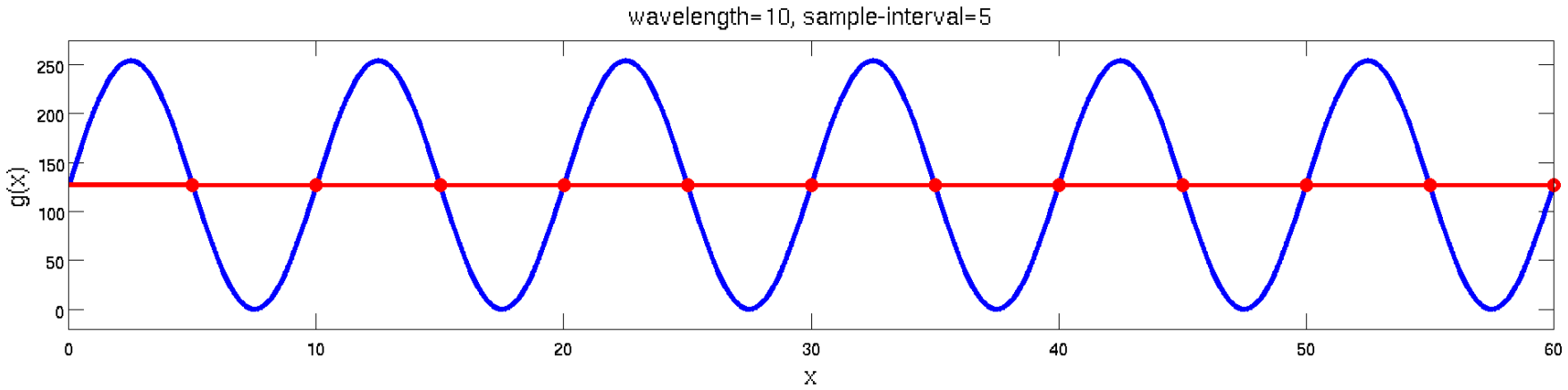
Sampling: Moiré Patterns cont.

- 1D-example of Moiré patterns:



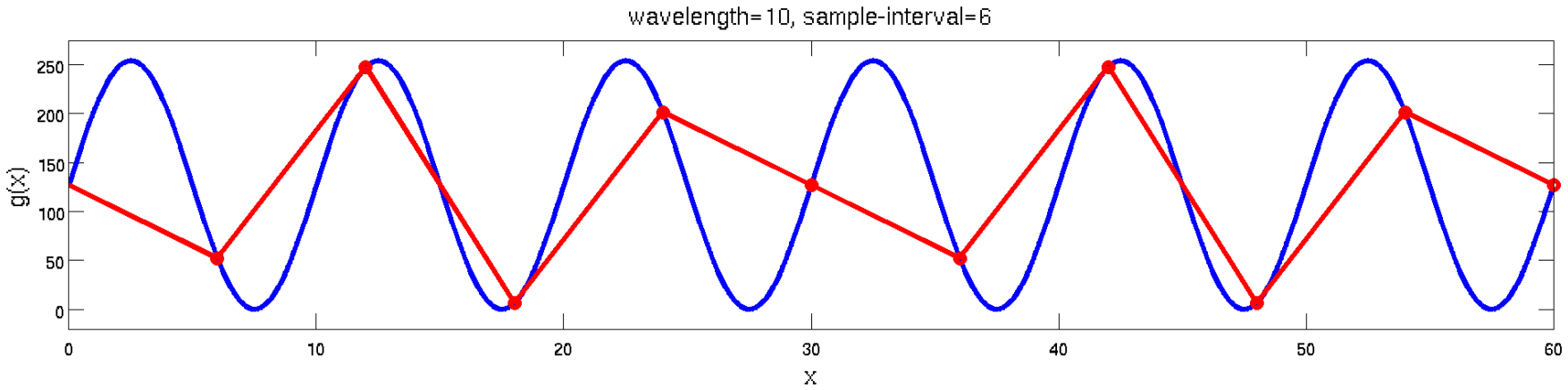
Sampling: Moiré Patterns cont.

- 1D-example of Moiré patterns:



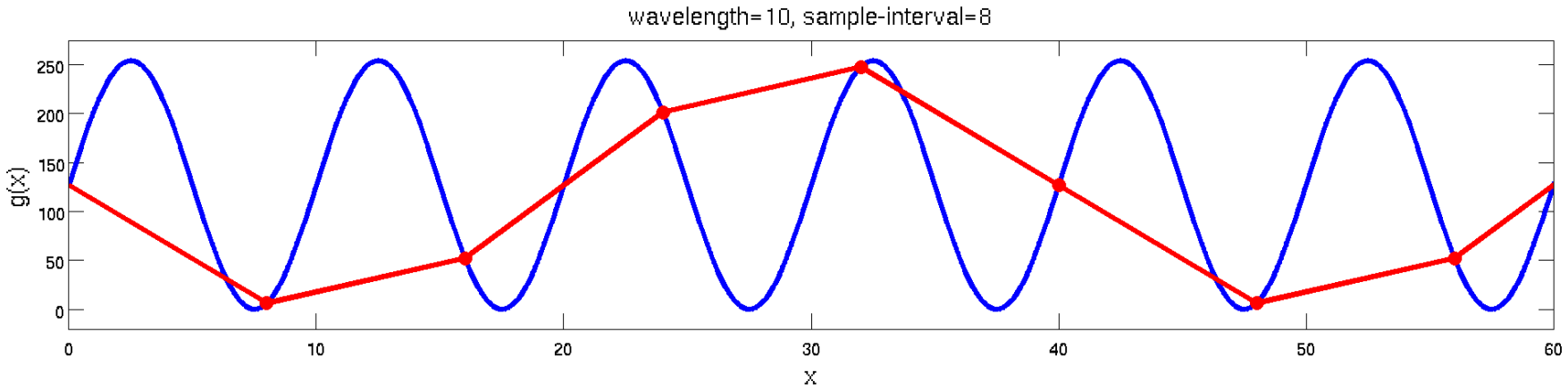
Sampling: Moiré Patterns cont.

- 1D-example of Moiré patterns:



Sampling: Moiré Patterns cont.

- 1D-example of Moiré patterns:



The occurrence of Moiré patterns depends on the sampling rate compared to the maximal frequency of the signal (image)

Slide 43

Convolution of Images

- Example

g :

3	4	2	2	2	2	4
5	2	1	1	1	0	2
6	3	2	2	0	1	3
4	4	8	5	4	7	3
6	6	7	8	9	9	7

f :

2	2	1
1	0	0
0	1	3

$g * f$:

	30	26	15	12	18	
	47	39	30	32	30	
	61	52	53	57	45	

$$
\begin{aligned}
(g * f)(5,1) = \\
&+ f(-1,-1)g(6,2) + f(0,-1)g(5,2) + f(1,-1)g(4,2) \\
&+ f(-1,0)g(6,1) + f(0,0)g(5,1) + f(1,0)g(4,1) \\
&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
\end{aligned}
$$

$$
(g * f)(u,v) = \sum_{k=-\infty}^{\infty} \sum_{l=-\infty}^{\infty} f(k,l)g(u-k, v-l)
$$

Convolution of Images

- Example

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&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
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Convolution of Images

- Example

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&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
\end{aligned}
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Convolution of Images

- Example

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&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
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Convolution of Images

- Example

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&+ f(-1,0)g(6,1) + f(0,0)g(5,1) + f(1,0)g(4,1) \\
&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
\end{aligned}
$$

$$
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Convolution of Images

- Example

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&+ f(-1,0)g(6,1) + f(0,0)g(5,1) + f(1,0)g(4,1) \\
&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
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Convolution of Images

- Example

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&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
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Convolution of Images

- Example

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Convolution of Images

- Example

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&+ f(-1,0)g(6,1) + f(0,0)g(5,1) + f(1,0)g(4,1) \\
&+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)
\end{aligned}
$$

$$
(g * f)(u,v) = \sum_{k=-\infty}^{\infty} \sum_{l=-\infty}^{\infty} f(k,l)g(u-k, v-l)
$$

Convolution of Images

- Example

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$g * f$:

	30	26	15	12	18	
	47	39	30	32	30	
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$$(g * f)(5,1) =$$
$$+ f(-1,-1)g(6,2) + f(0,-1)g(5,2) + f(1,-1)g(4,2)$$
$$+ f(-1,0)g(6,1) + f(0,0)g(5,1) + f(1,0)g(4,1)$$
$$+ f(-1,1)g(6,0) + f(0,1)g(5,0) + f(1,1)g(4,0)$$

boundary pixels are typically left free since convolution requires evaluation of pixels outside of image *g*

$$(g * f)(u,v) = \sum_{k=-\infty}^{\infty} \sum_{l=-\infty}^{\infty} f(k,l)g(u-k, v-l)$$