

# Image processing filtrovanie, konvolúcia





(a)



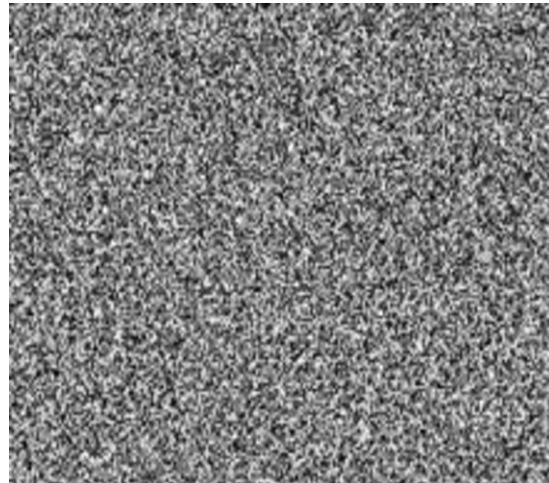
(b)



(c)

# Šum

- White noise
- Gaussian noise
- Quantization noise
- Impulse noise



Konvolúcia



45	60	98	127	132	133	137	133
46	65	98	123	126	128	131	133
47	65	96	115	119	123	135	137
47	63	91	107	113	122	138	134
50	59	80	97	110	123	133	134
49	53	68	83	97	113	128	133
50	50	58	70	84	102	116	126
50	50	52	58	69	86	101	120

$f(x,y)$

\*

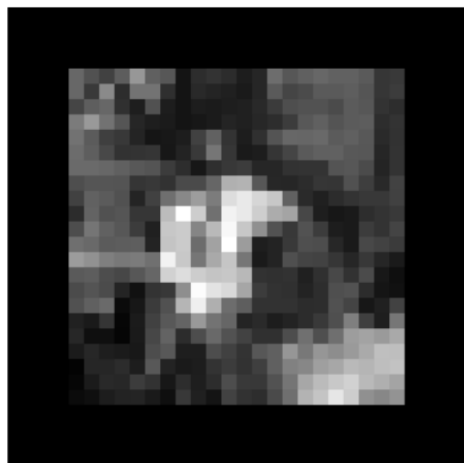
0.1	0.1	0.1
0.1	0.2	0.1
0.1	0.1	0.1

$h(x,y)$

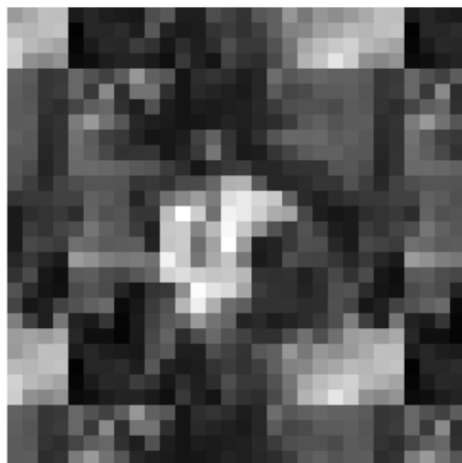
=

69	95	116	125	129	132
68	92	110	120	126	132
66	86	104	114	124	132
62	78	94	108	120	129
57	69	83	98	112	124
53	60	71	85	100	114

$g(x,y)$



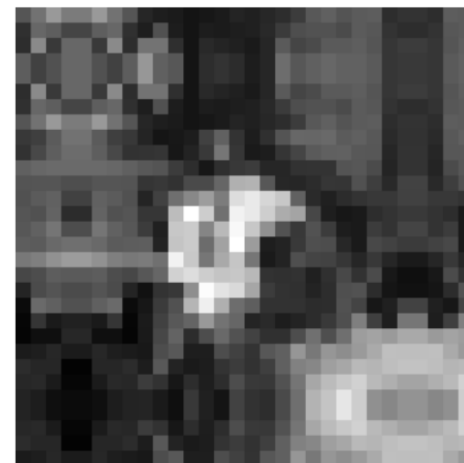
zero



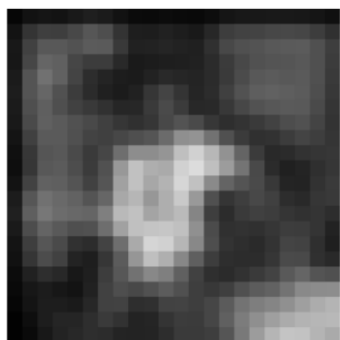
wrap



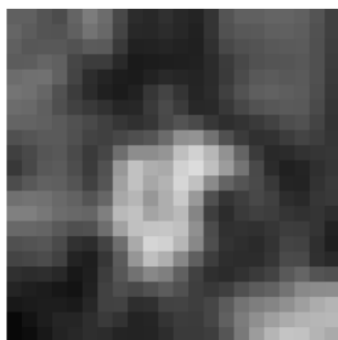
clamp



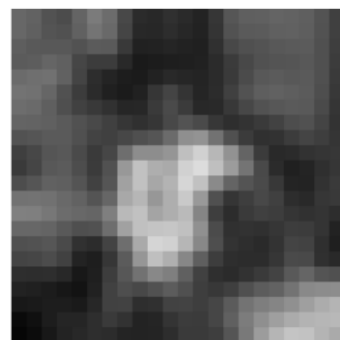
mirror



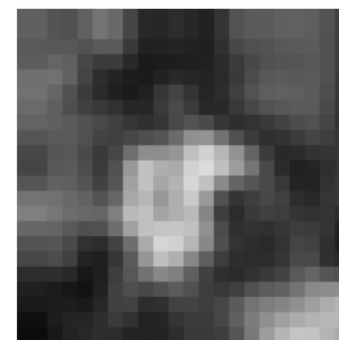
blurred zero



normalized zero



blurred clamp



blurred mirror

$\frac{1}{K^2}$	1	1	...	1
	1	1	...	1
	⋮	⋮	1	⋮
	1	1	...	1

$\frac{1}{16}$	1	2	1
	2	4	2
	1	2	1

$\frac{1}{256}$	1	4	6	4	1
	4	16	24	16	4
	6	24	36	24	6
	4	16	24	16	4
	1	4	6	4	1

$\frac{1}{8}$	-1	0	1
	-2	0	2
	-1	0	1

$\frac{1}{4}$	1	-2	1
	-2	4	-2
	1	-2	1

$\frac{1}{K}$	1	1	...	1
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$\frac{1}{4}$	1	2	1
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$\frac{1}{16}$	1	4	6	4	1
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$\frac{1}{2}$	-1	0	1
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$\frac{1}{2}$	1	-2	1
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(a) box,  $K = 5$

(b) bilinear

(c) “Gaussian”

(d) Sobel

(e) corner