Morfologie a tvarové charakteristiky

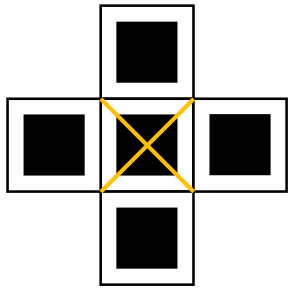
Strojové vidění a zpracování obrazu (BI-SVZ)

Morfologie v biologii

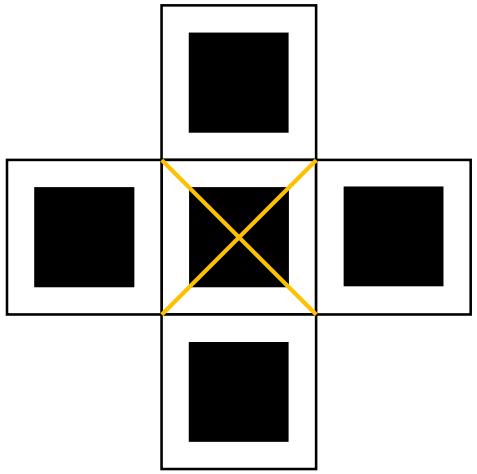
Studium velikosti, tvaru a vnitřní struktury zvířat, rostlin a mikroorganismů a hledání souvislostí mezi jejich vnitřními částmi.

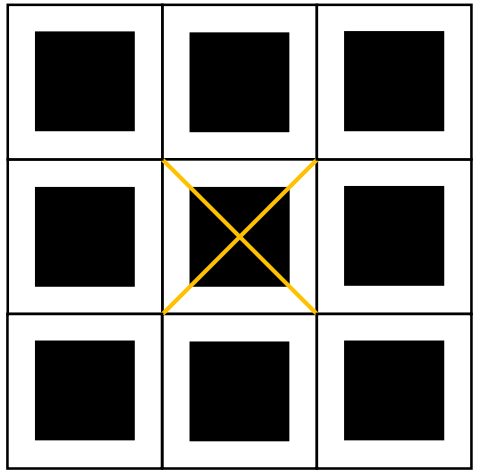
Morfologie ve zpracování obrazu

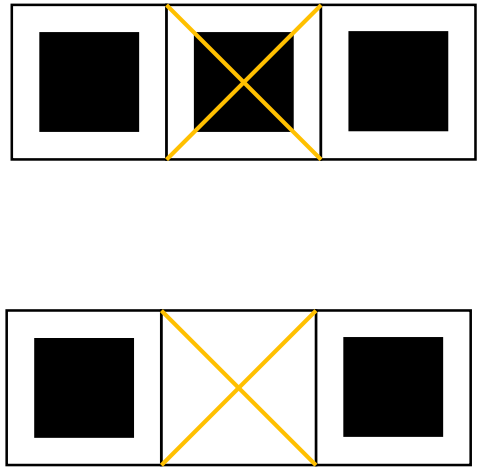
Způsob, jak odhalit a získat znalosti z diskrétního obrazu pomocí jeho postupné analýzy malou sondou – strukturním elementem.

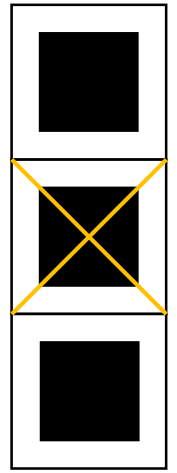


Strukturní element

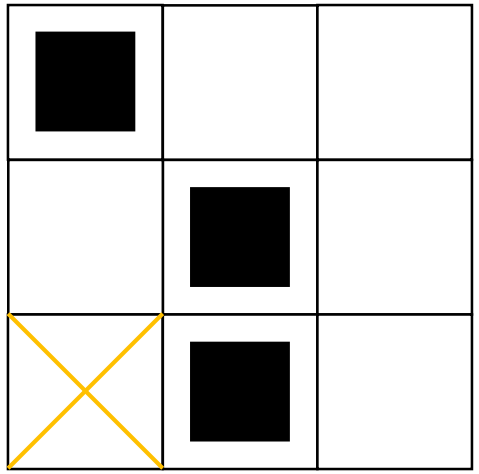


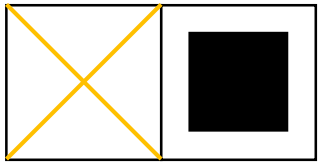






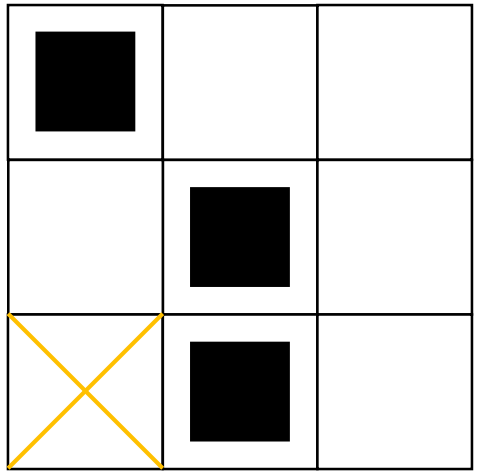
Strukturní element – porovnávání

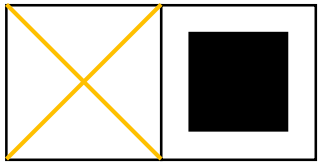




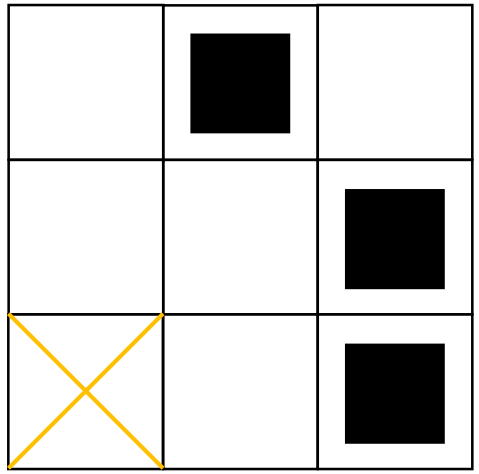
Postupný posun po obrázku a zjišťování,
zda v počátku SE je objekt (1)

Strukturní element – porovnávání

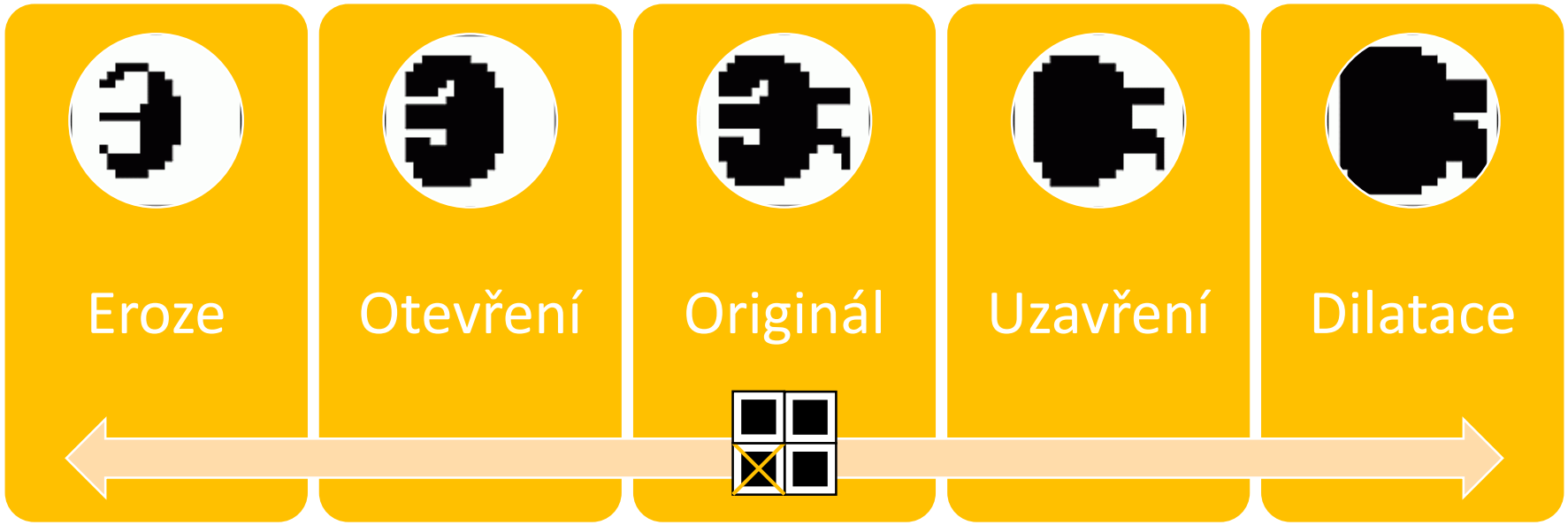




= SE posun doleva



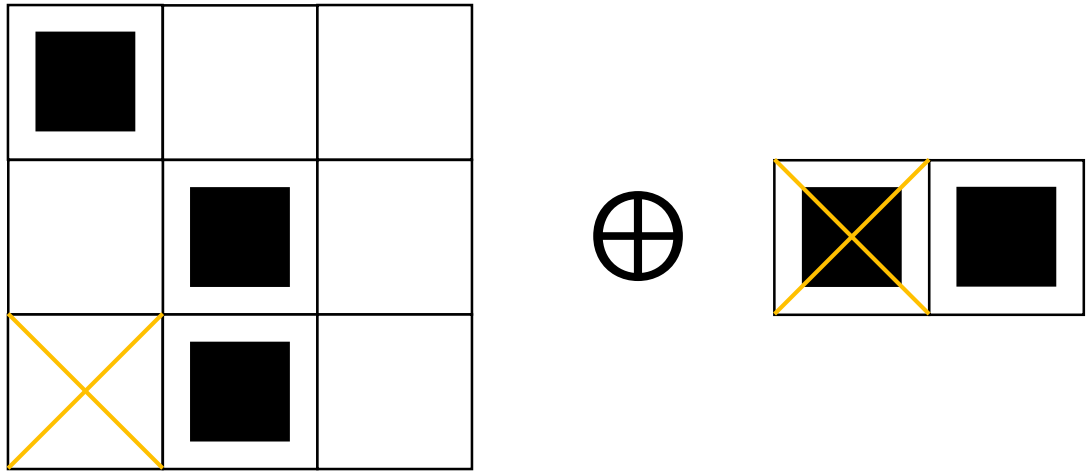
Metody binární morfologie



SMITH, W. *Digital signal processing: scientist and engineer´s guide*. Vyd. 1. California: California Technical Publishing, 1997, 626 s. ISBN 09-660-1763-3.

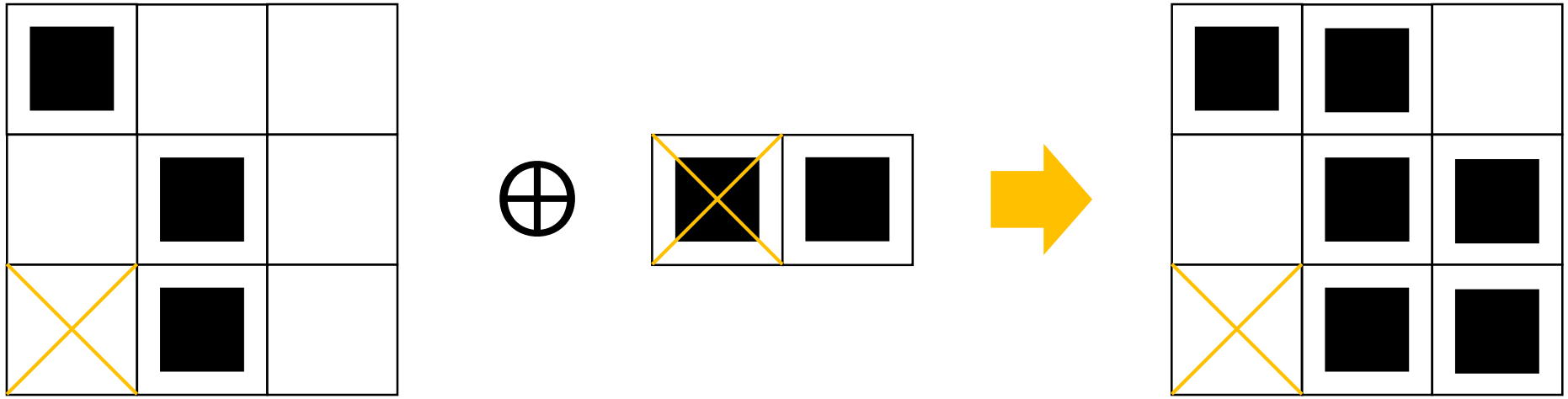
Dilatace

- Expanze objektu



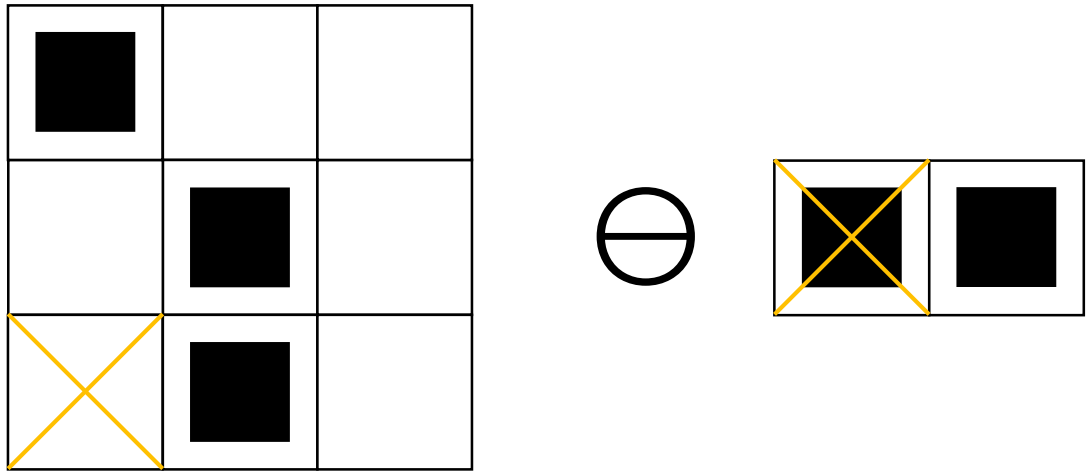
Dilatace

- Expanze objektu



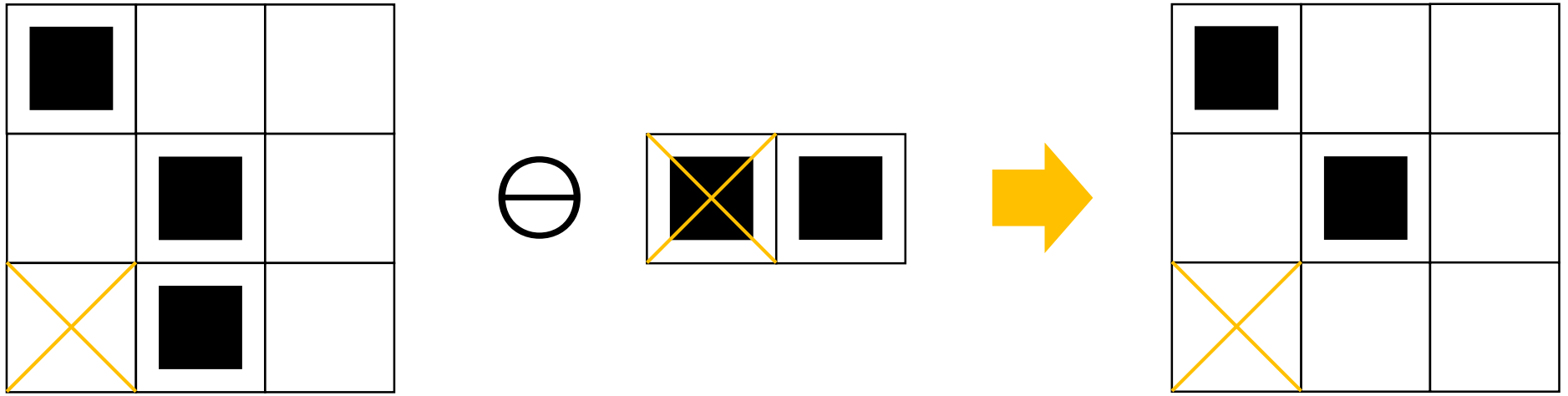
Eroze

- Kontrakce objektu
- Oddělení objektů

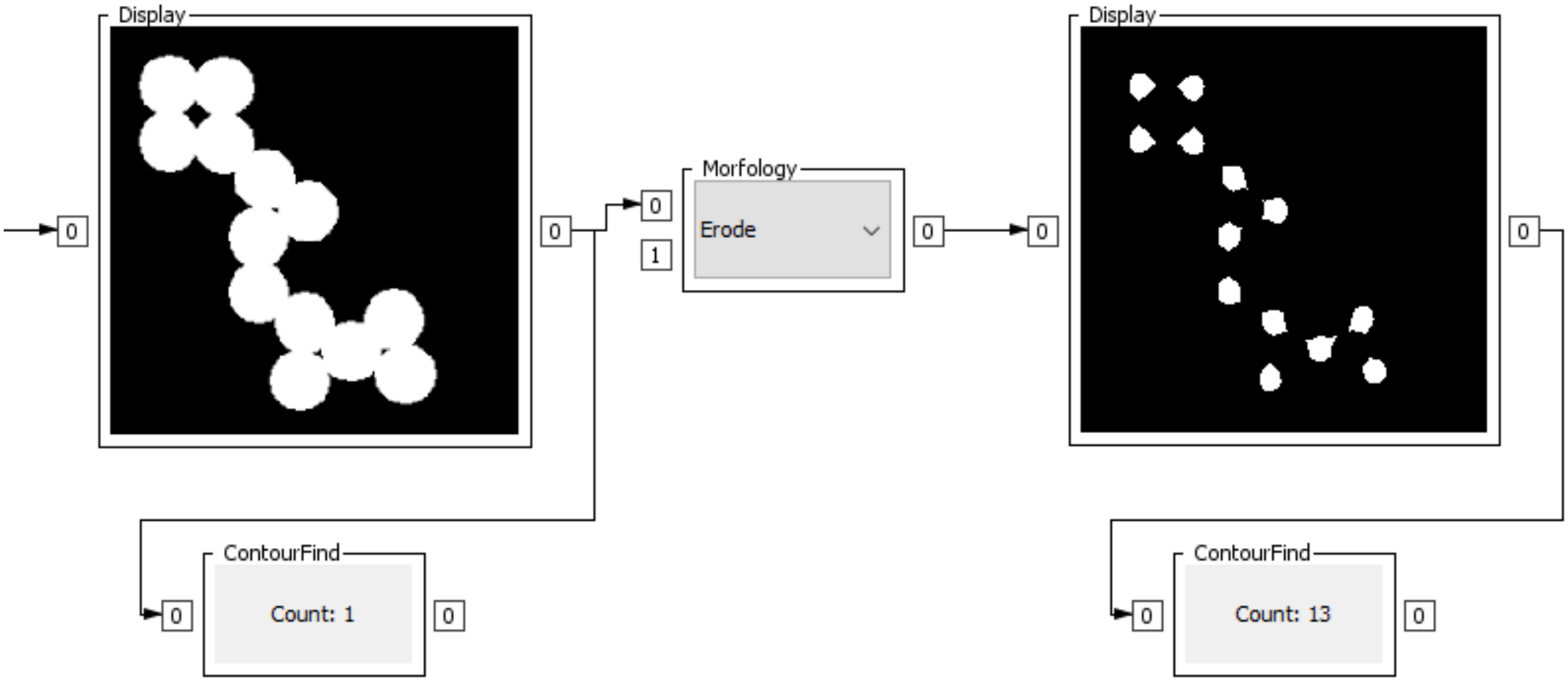


Eroze

- Kontrakce objektu
- Oddělení objektů



Eroze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ContourFind
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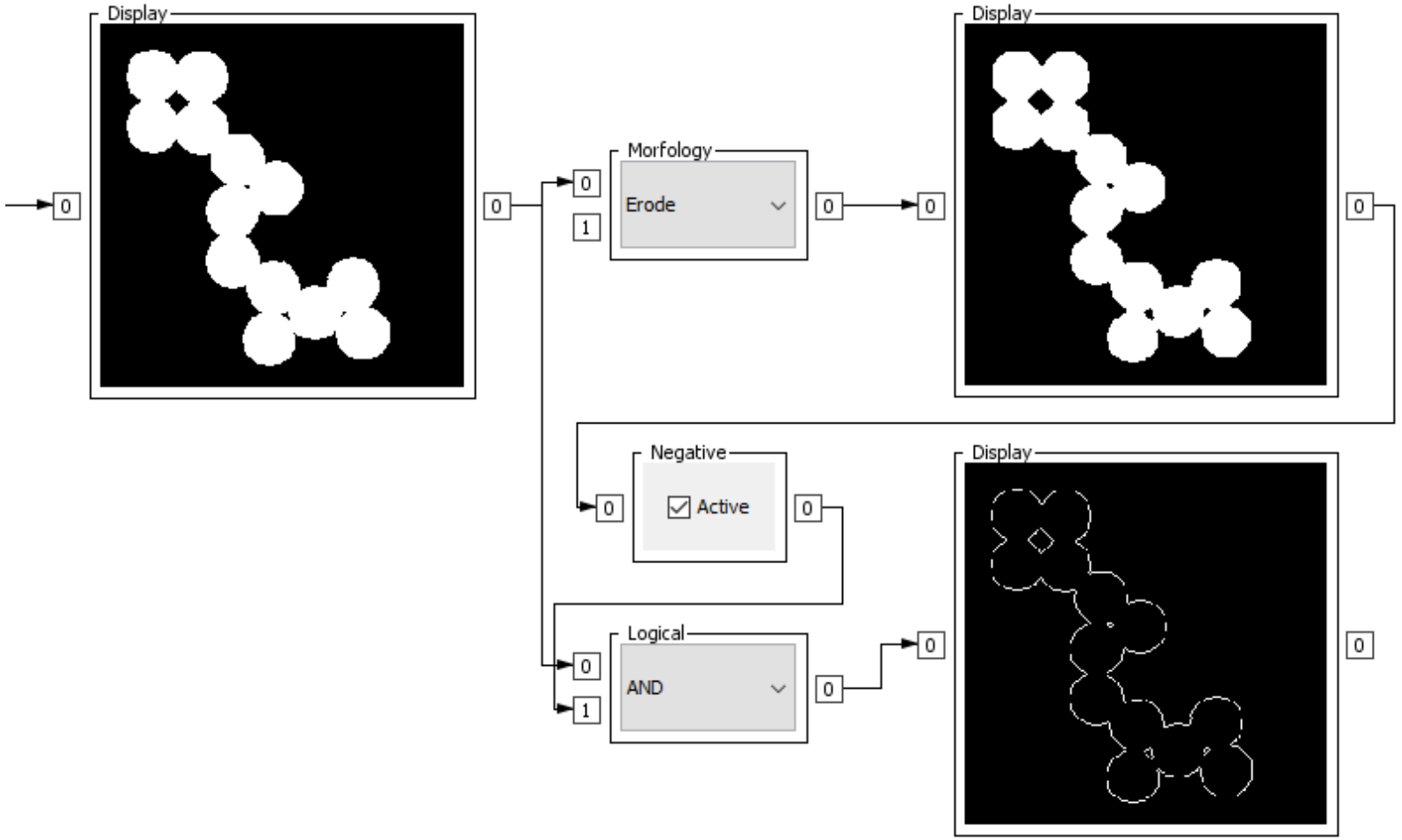
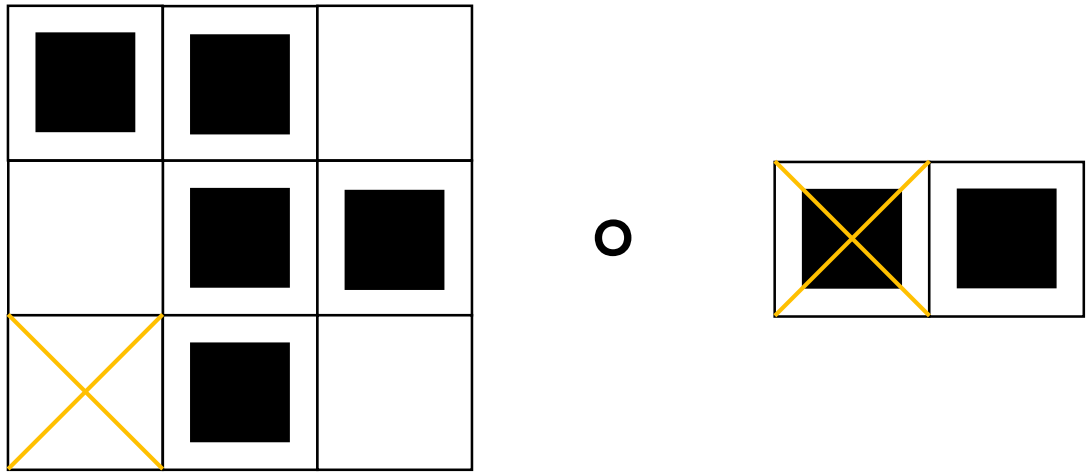
Eroze – zisk kontur

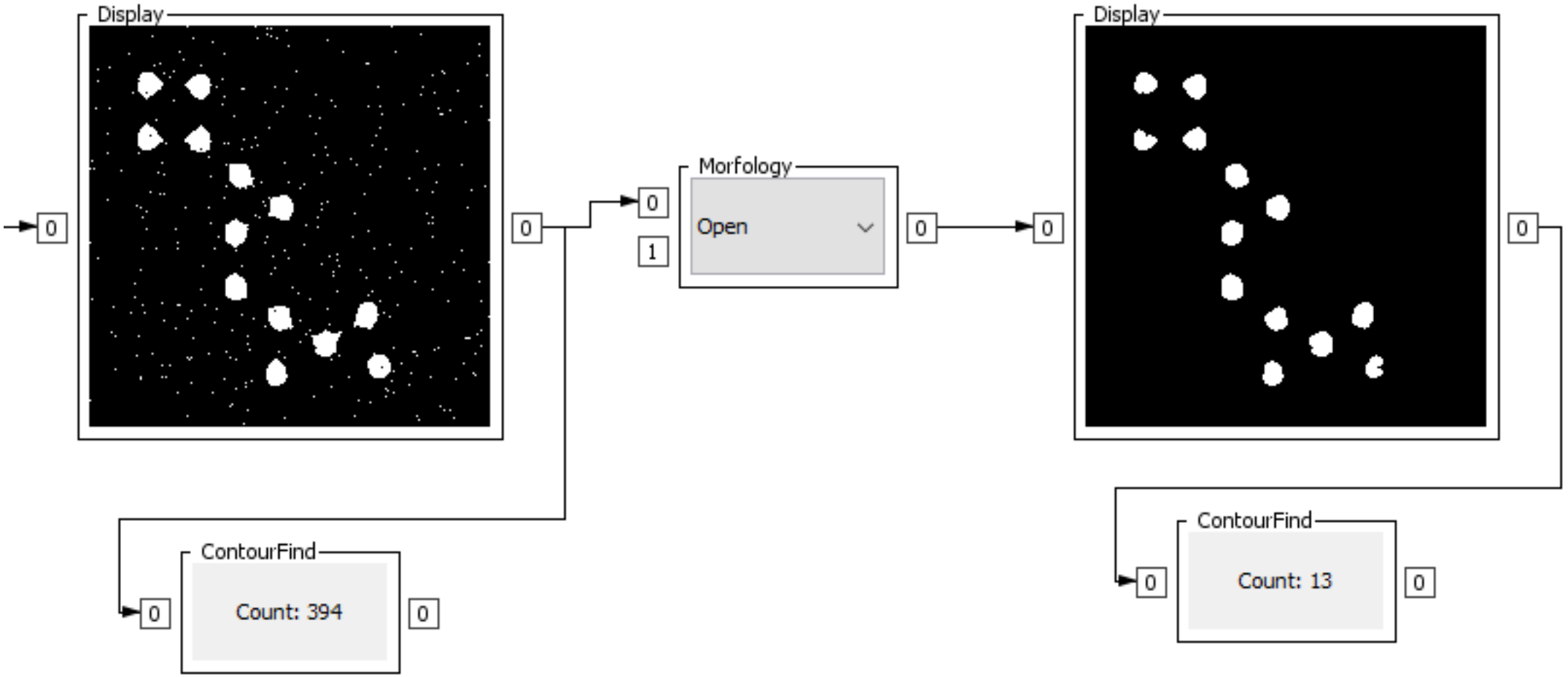


Otevření

- Zbavení se šumu
- Nejdřív eroze, potom dilatace



Otevření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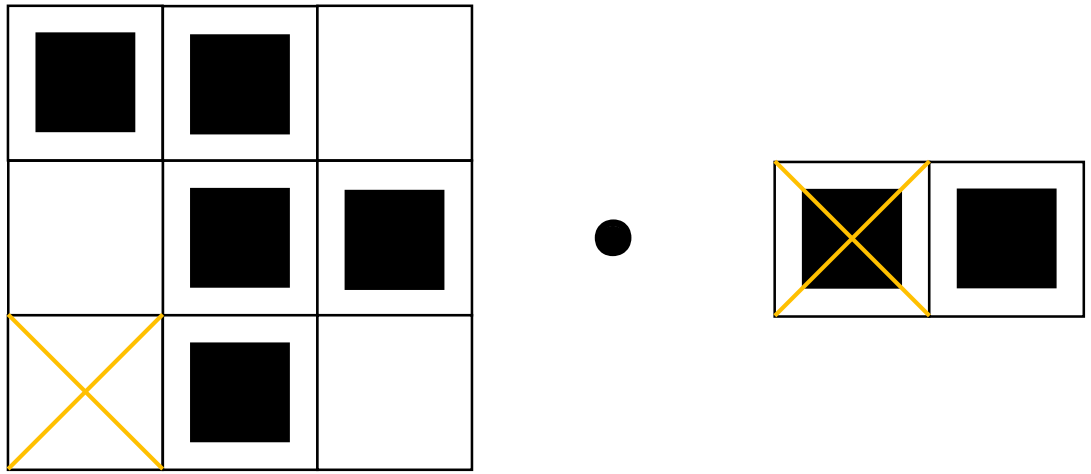
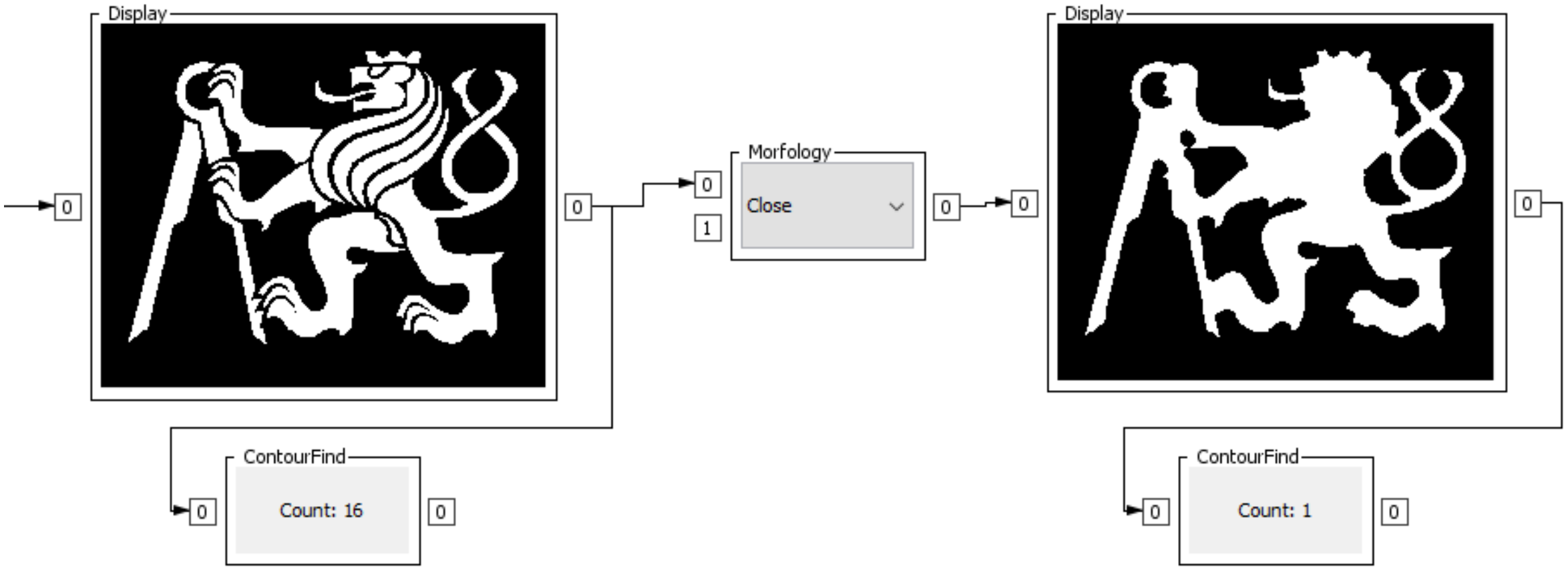
Uzavření

- Spojení objektů, zaplnění děr,
- Nejdřív dilatace, potom eroze



Uzavření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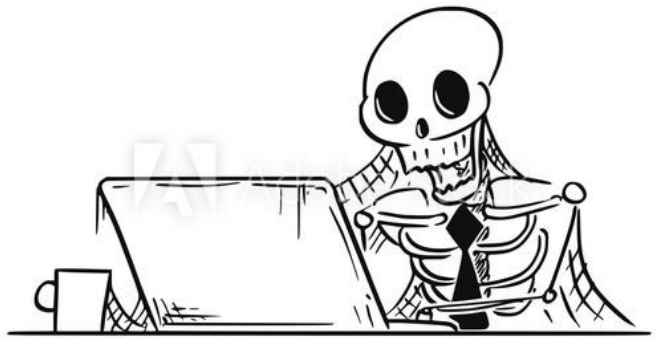
Skeletonizace

- Vytvoření binárního skeletonu
- Spojení středů největších vepsaných kruhů

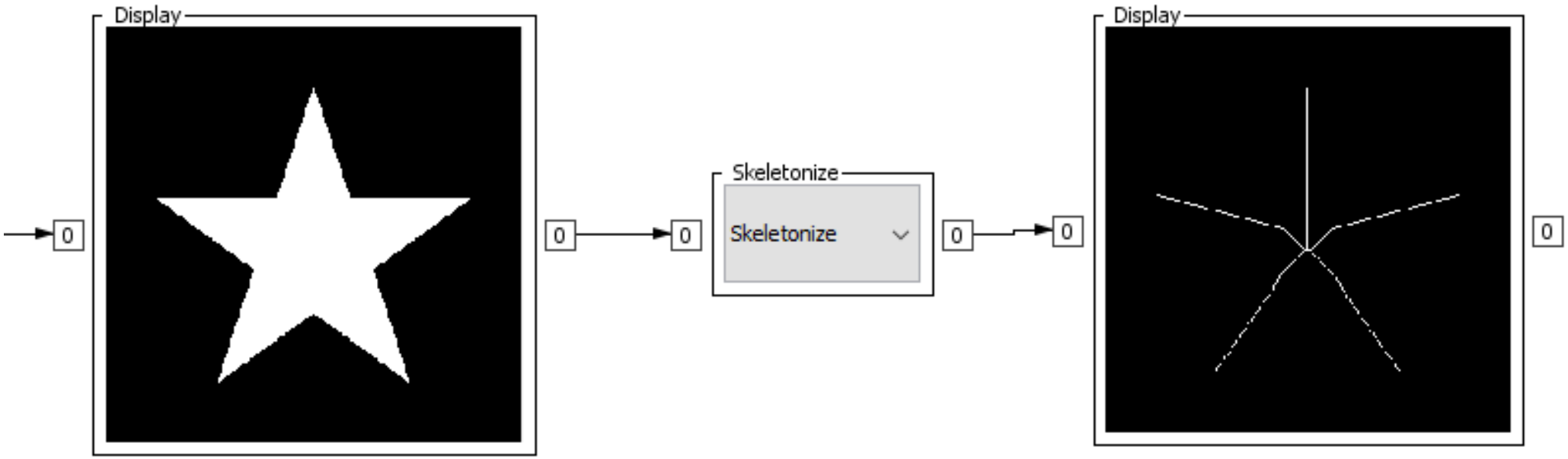
- Vzdálenostní transformace × Tenčení

- Aproximace přímkami
  - Geometrie objektu
- Detekce konců

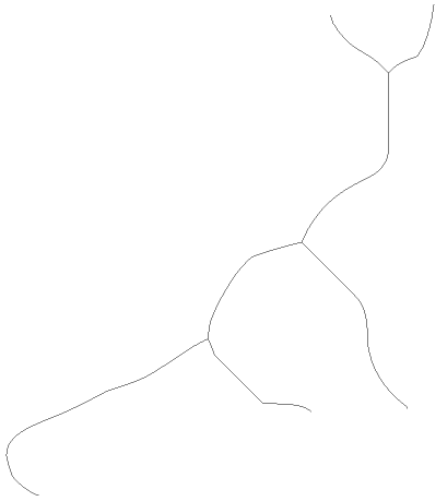


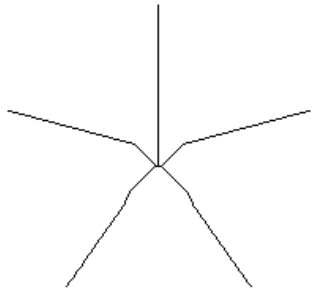
https://stock.adobe.com/cz/images/cartoon-illustration-of-human-skeleton-of-dead-businessman-sitting-in-front-of-computer/166967190

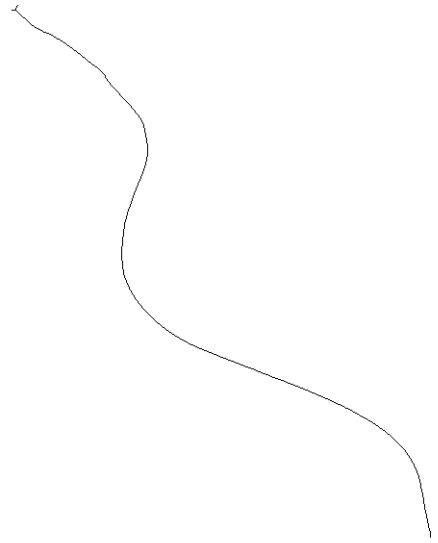
Skeletonizace (medial-axis transform)

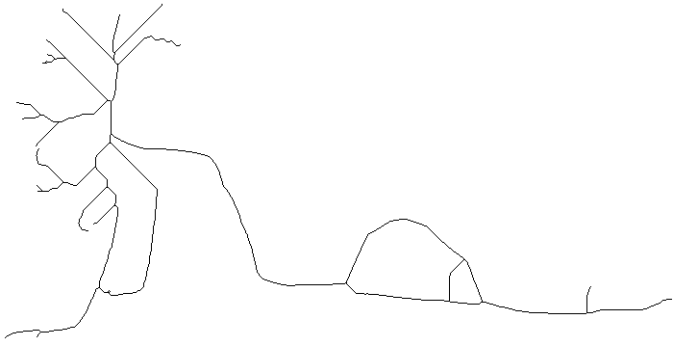


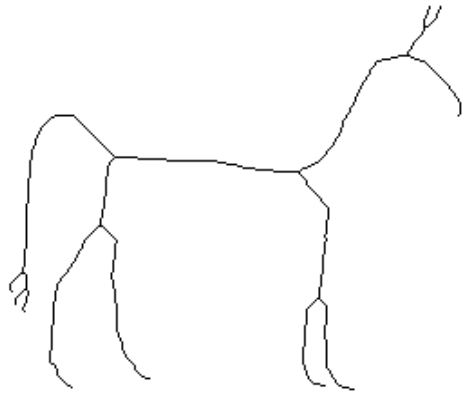
Skeletonizace



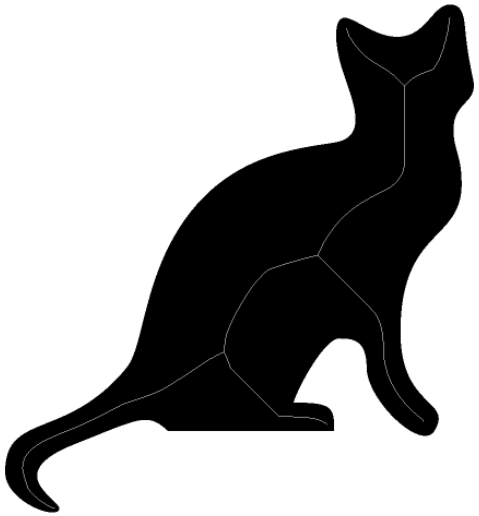


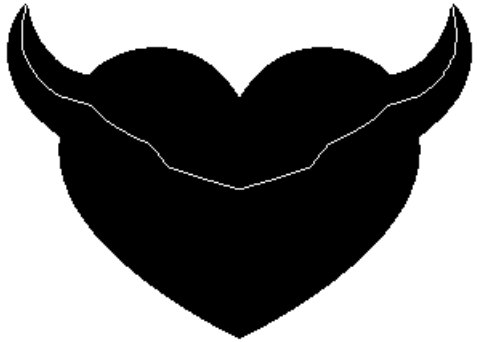


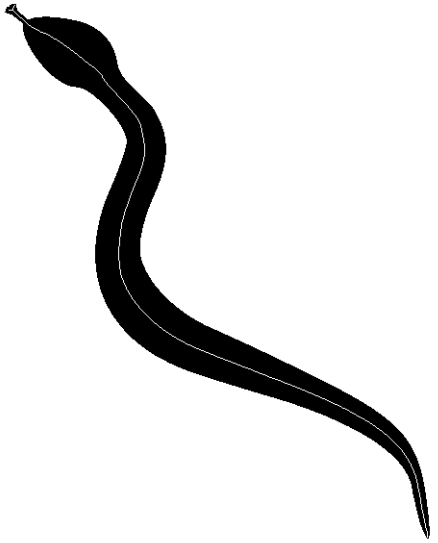


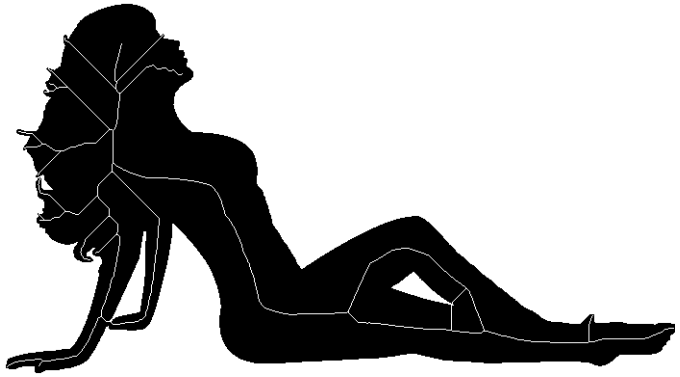


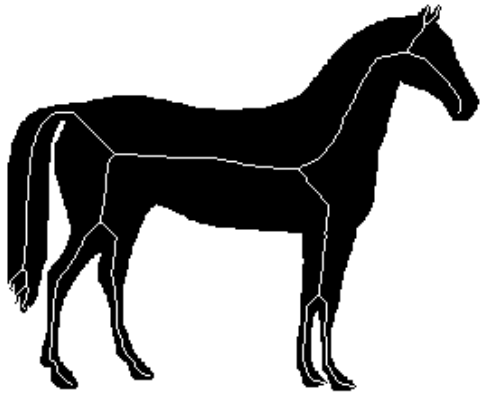
Skeletonizace





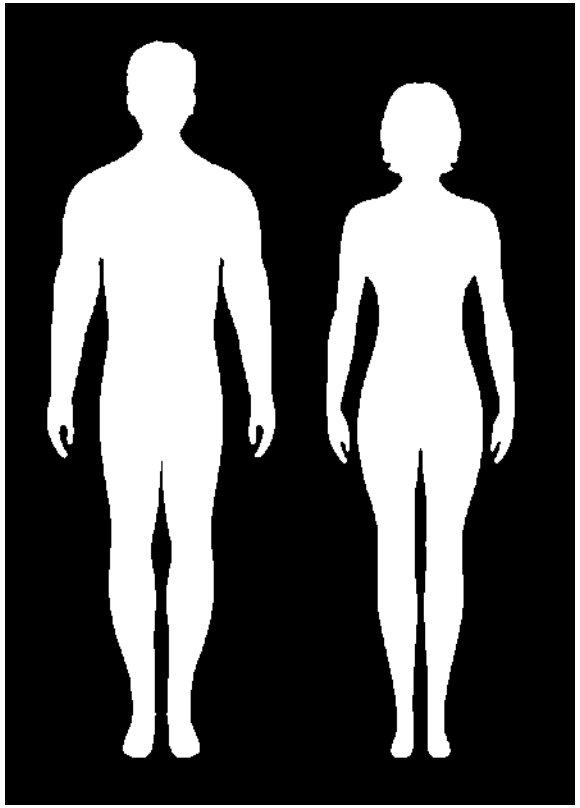


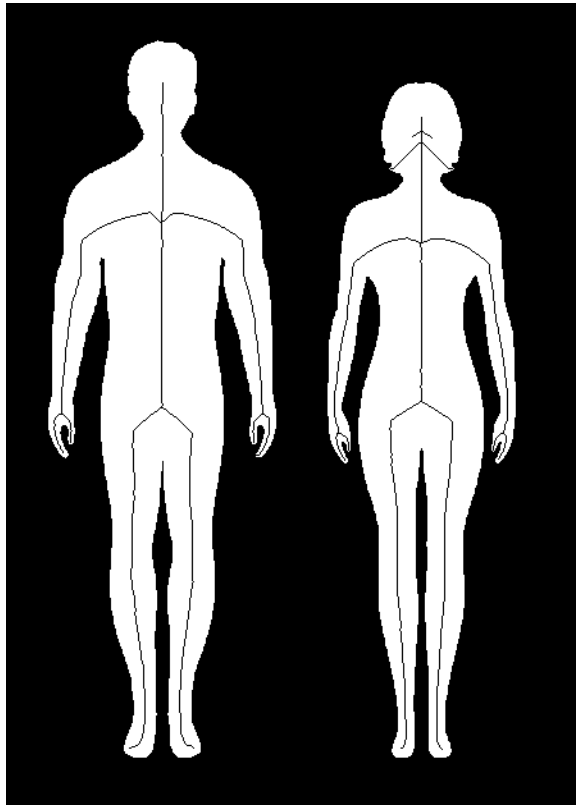




Pruning

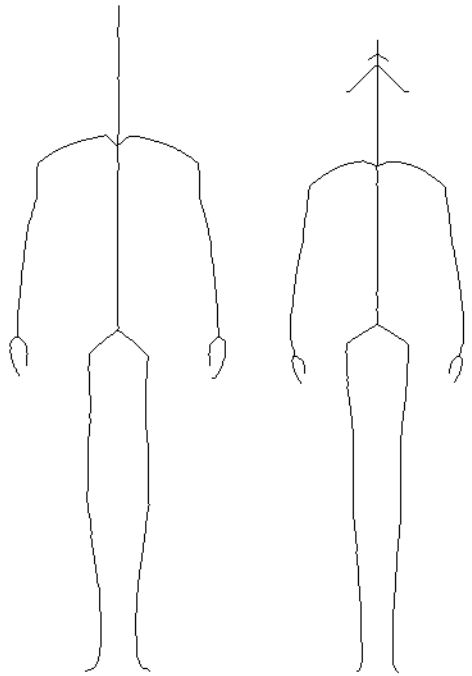
- Ořezání volných konců





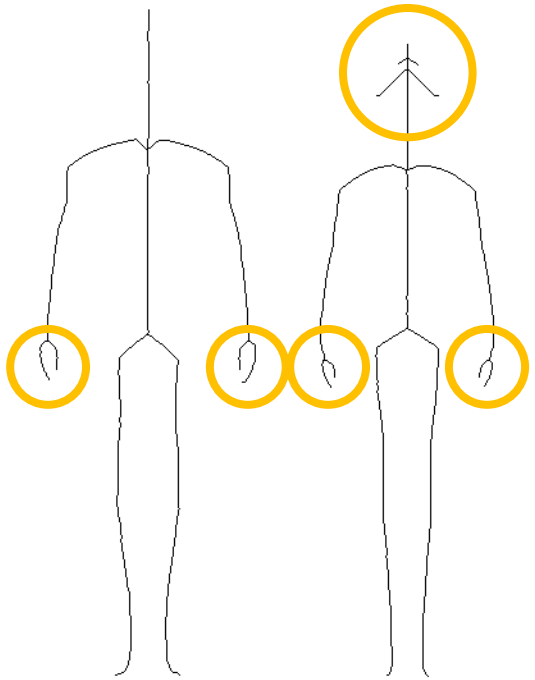
Pruning

- Ořezání volných konců



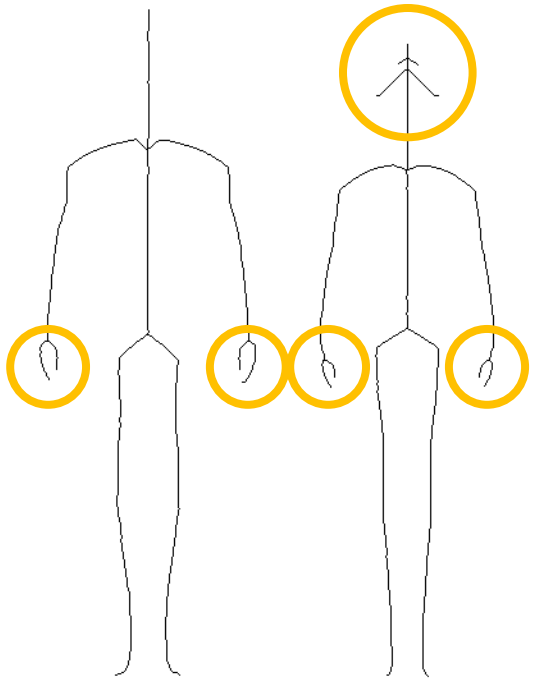
Pruning

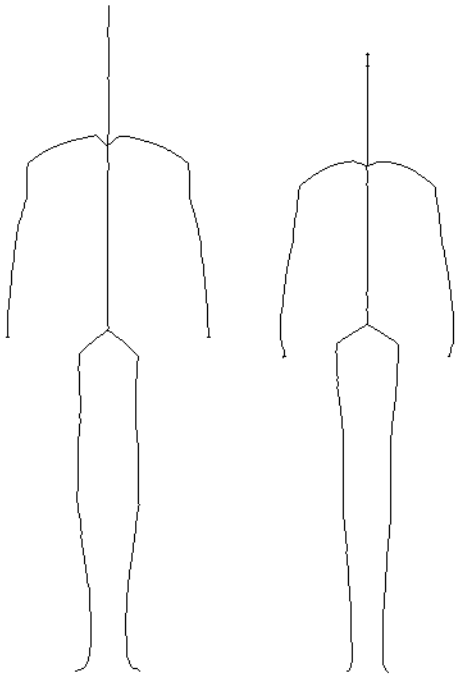
- Ořezání volných konců



Pruning

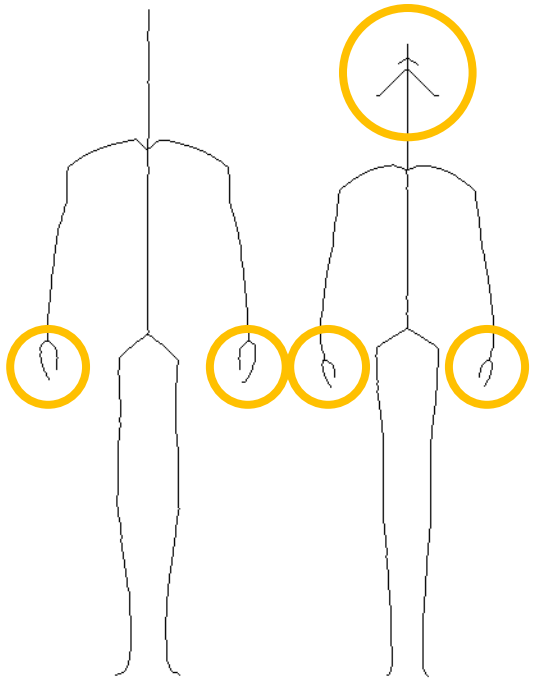
- Ořezání volných konců

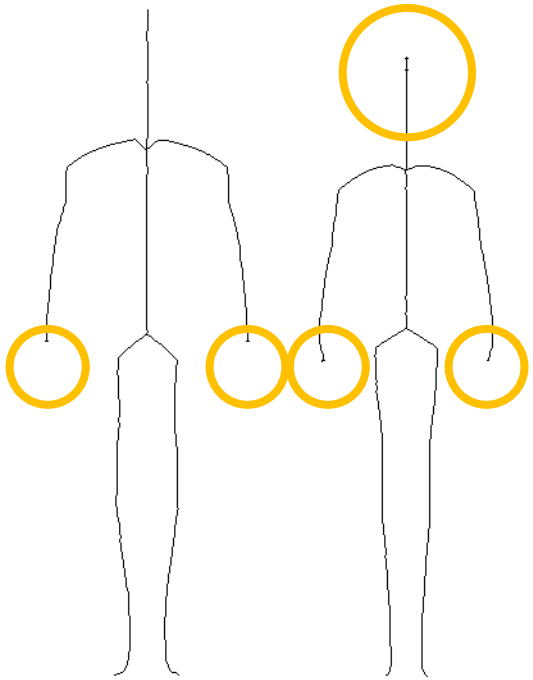




Pruning

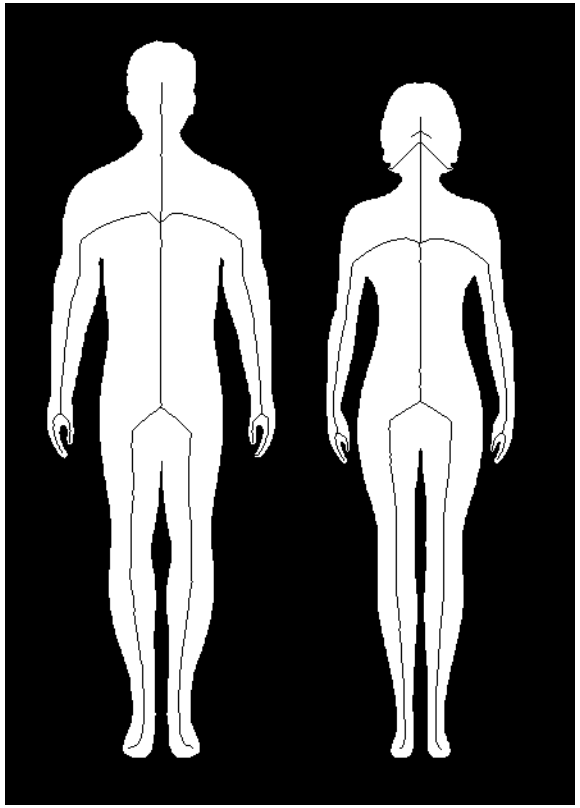
- Ořezání volných konců

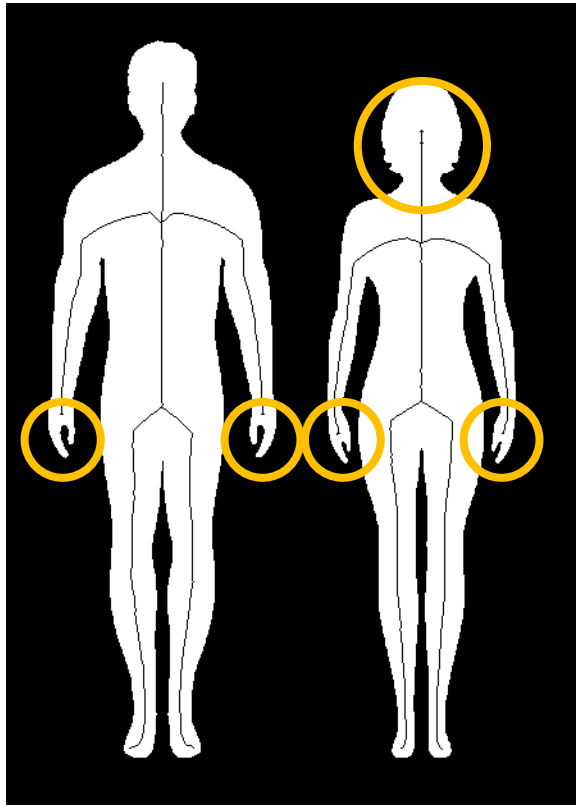




Pruning

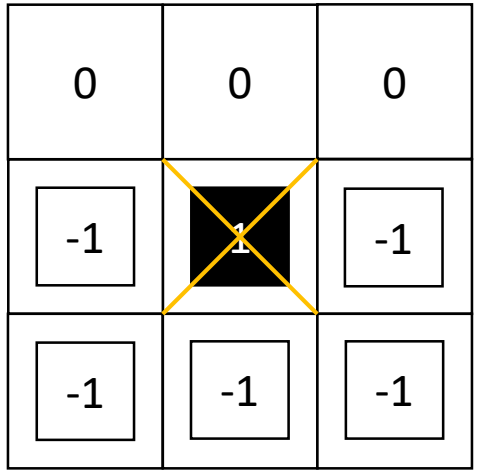
- Ořezání volných konců





Hit-or-miss transformace

- Detekce koncových bodů skeletonu

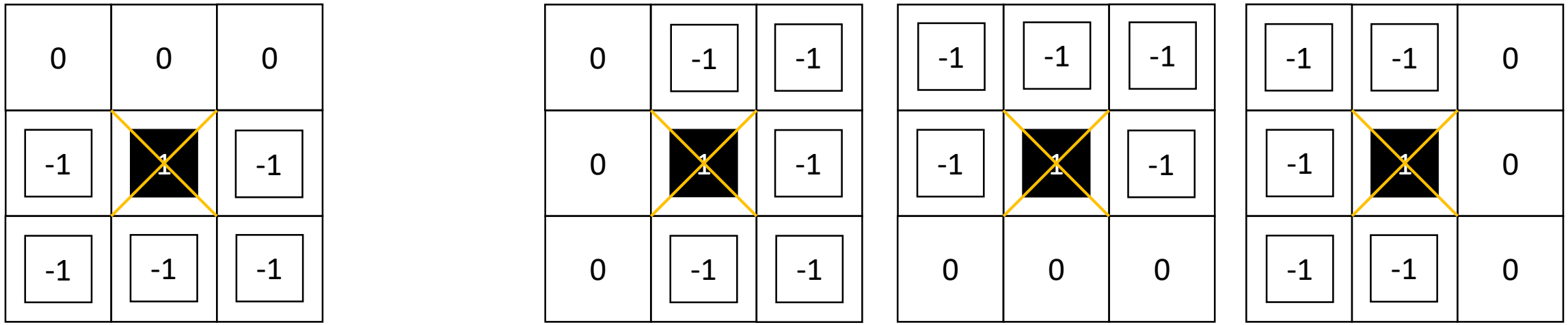


Speciální případ pro opencv

- 0 : nezájem
- 1 : popředí
- -1 : pozadí

Hit-or-miss transformace

- Detekce koncových bodů skeletonu

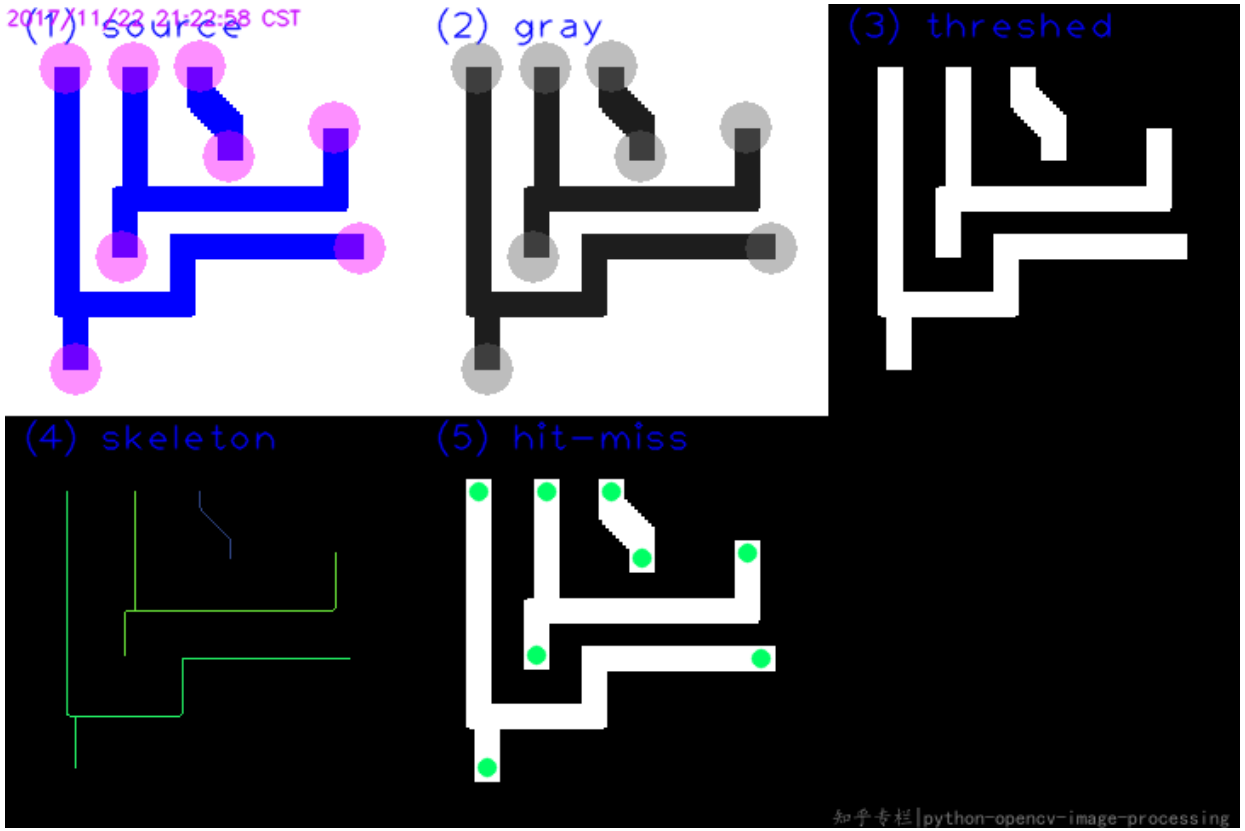


Speciální případ pro opencv

- 0 : nezájem
- 1 : popředí
- -1 : pozadí

4x

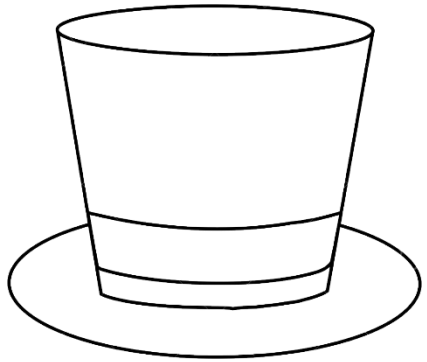
Hit-or-miss transformace



https://stackoverflow.com/a/47430038/1398955

Metody šedotónové morfologie

- Lze použít již zmíněné metody
- Nově
  - Top-hat transformace
  - Black-hat transformace



Metody šedotónové morfologie

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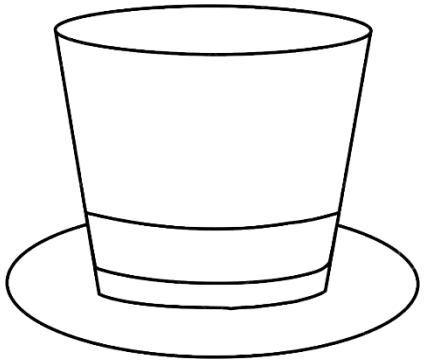
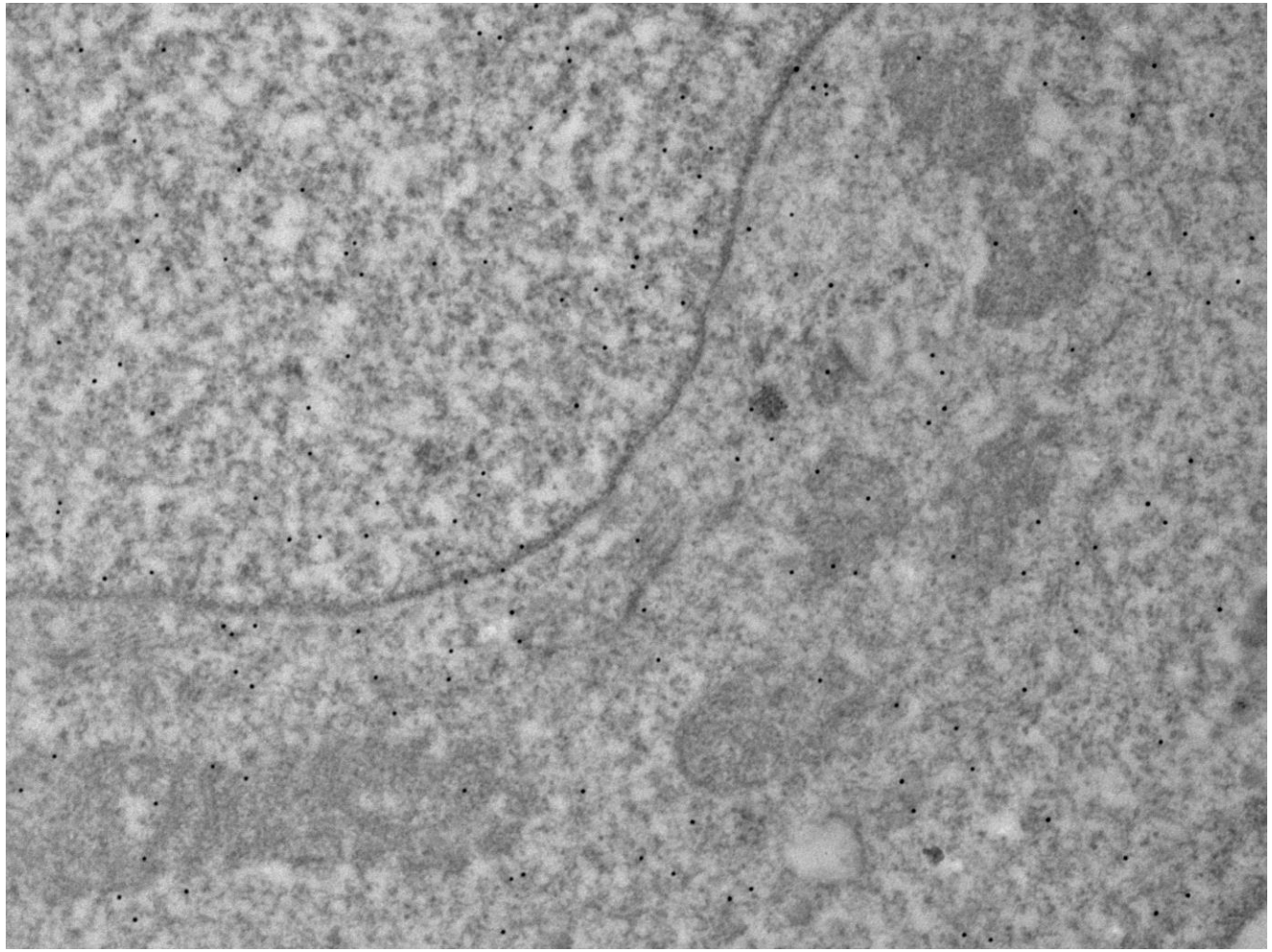
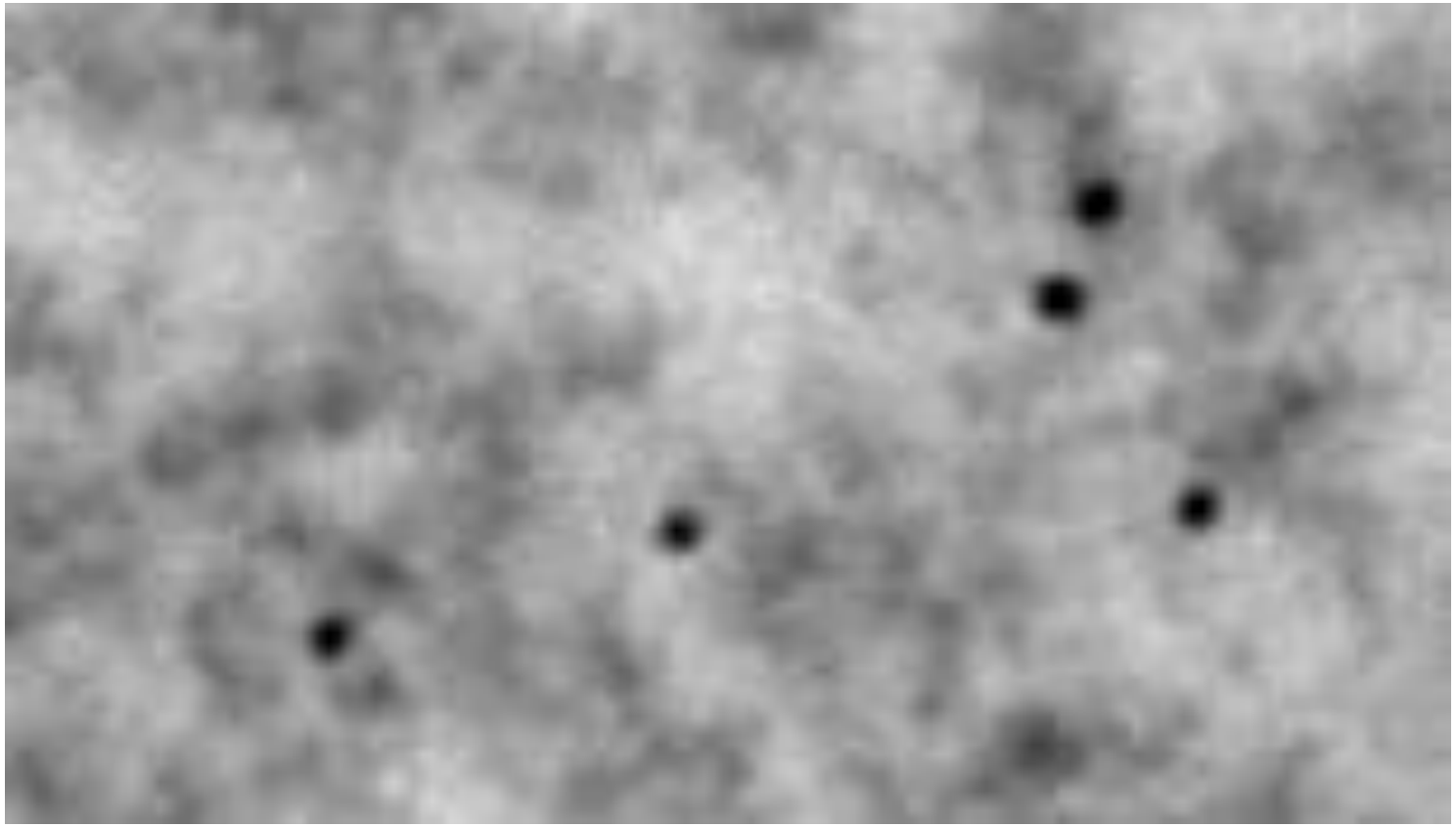
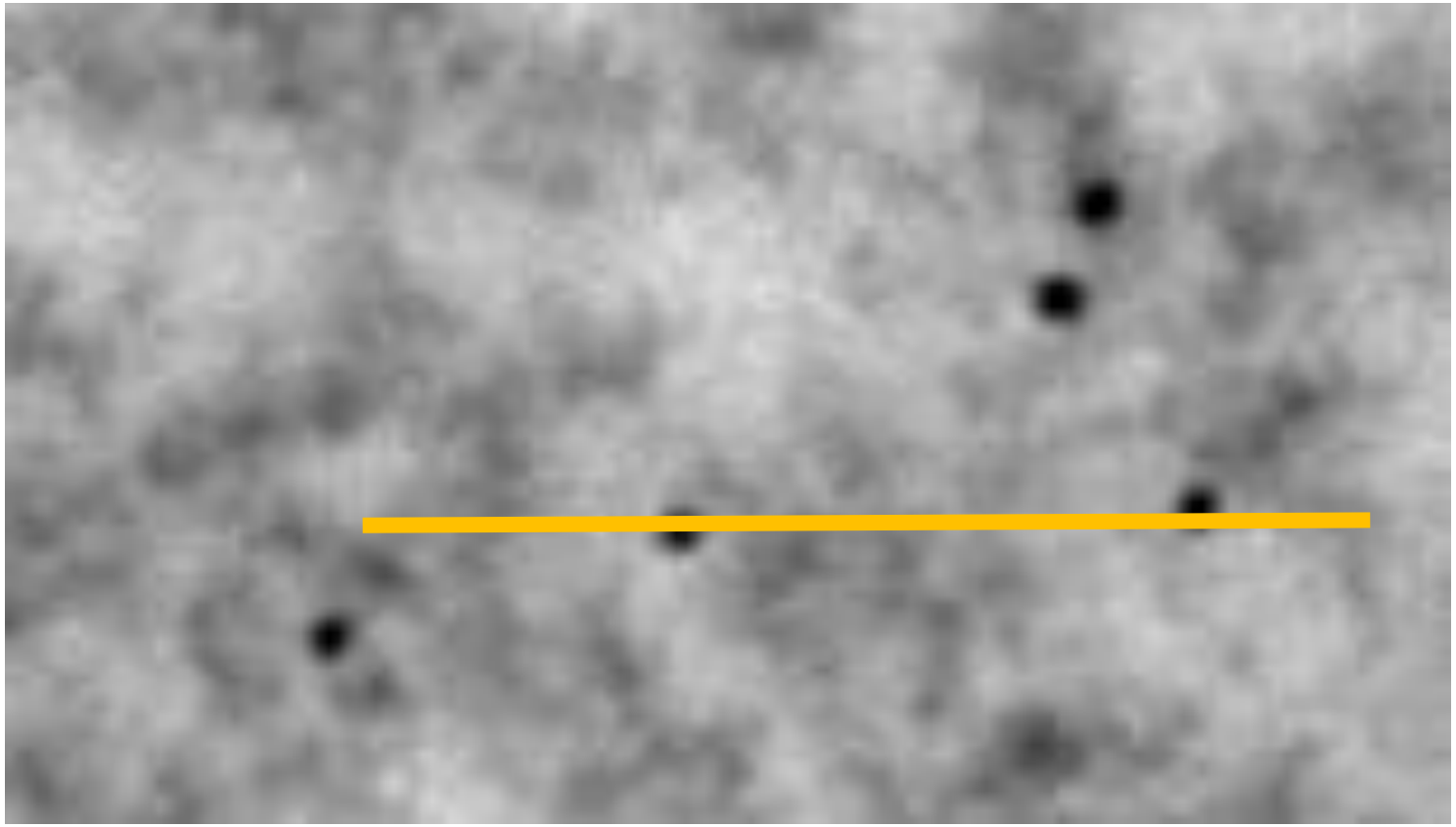




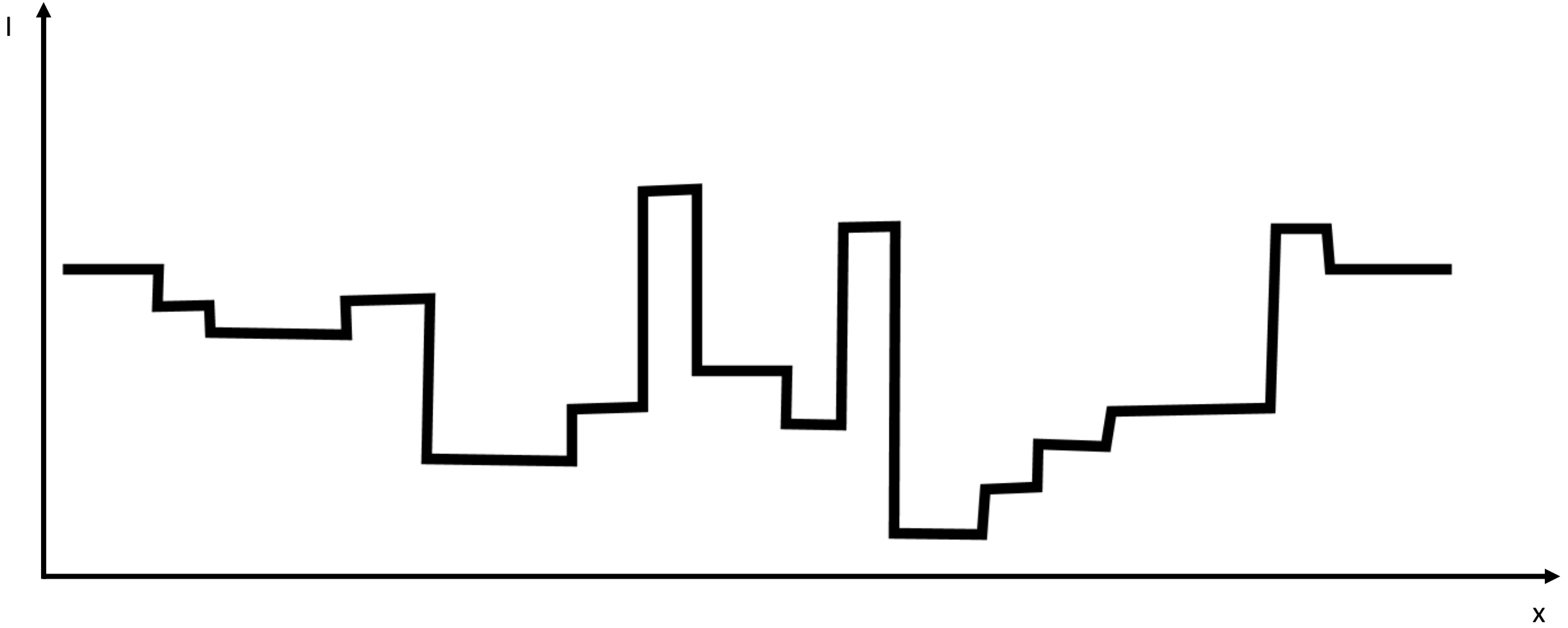
Top-hat transformace



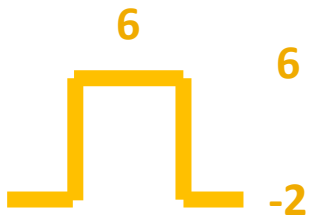
Top-hat transformace



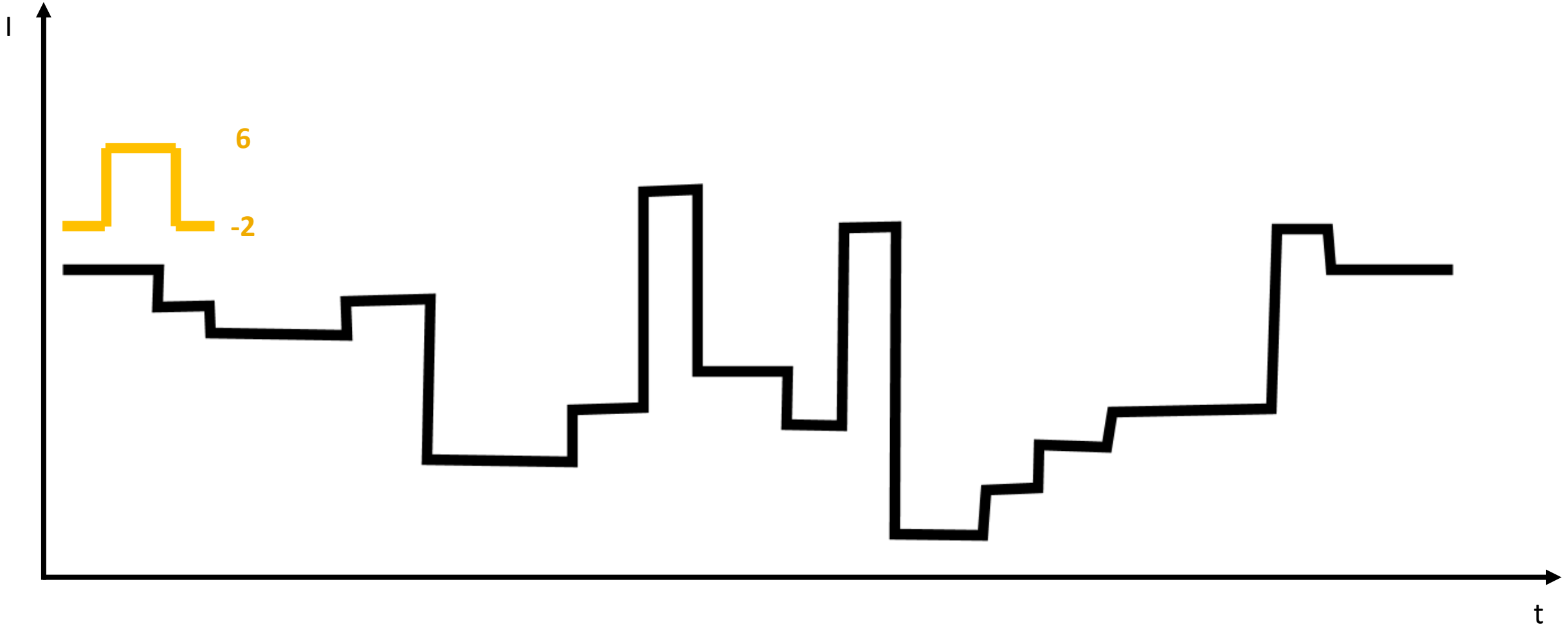
Top-hat transformace



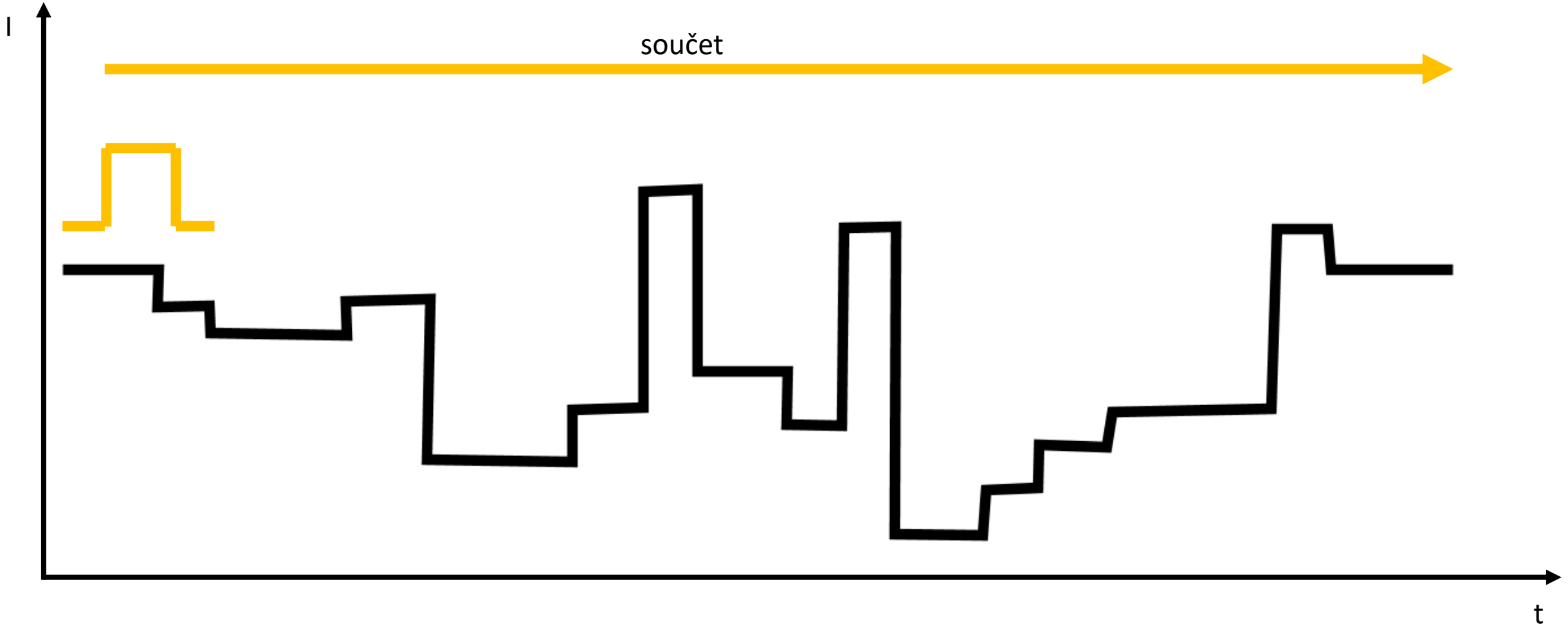
Top-hat transformace



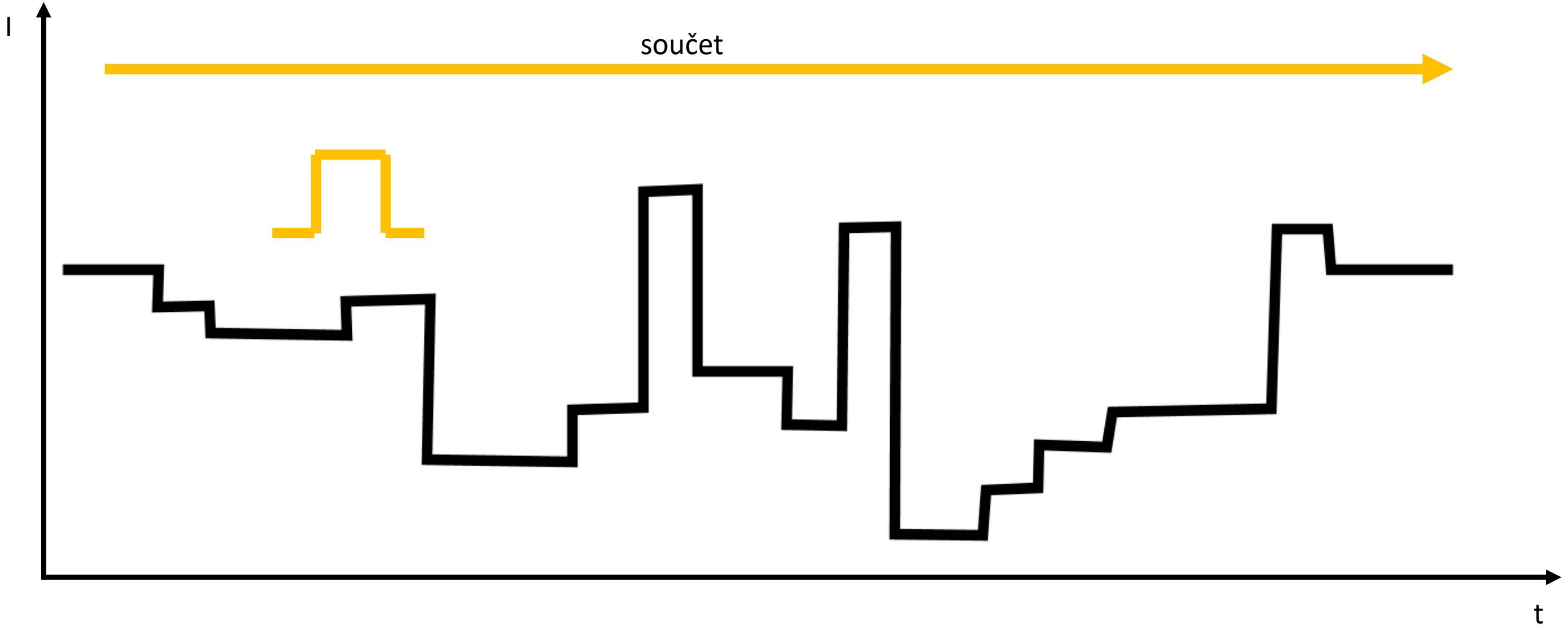
Top-hat transformace



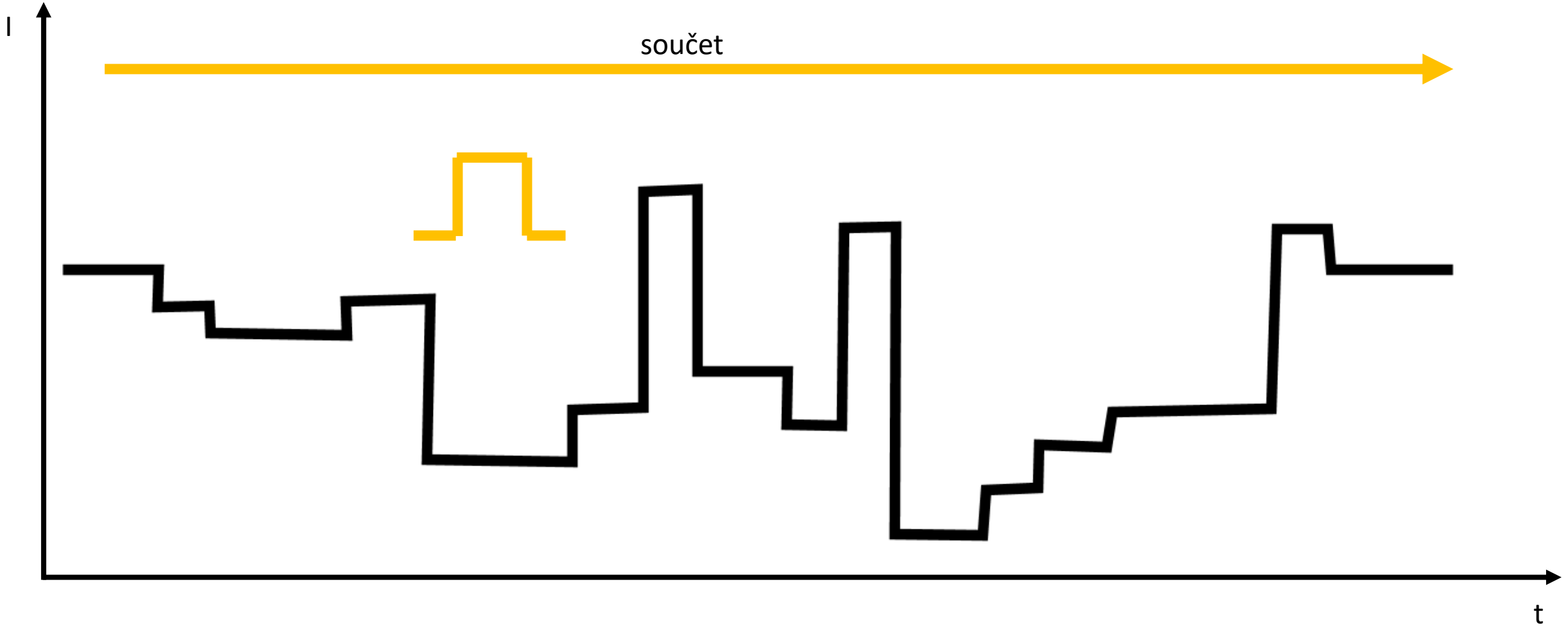
Top-hat transformace



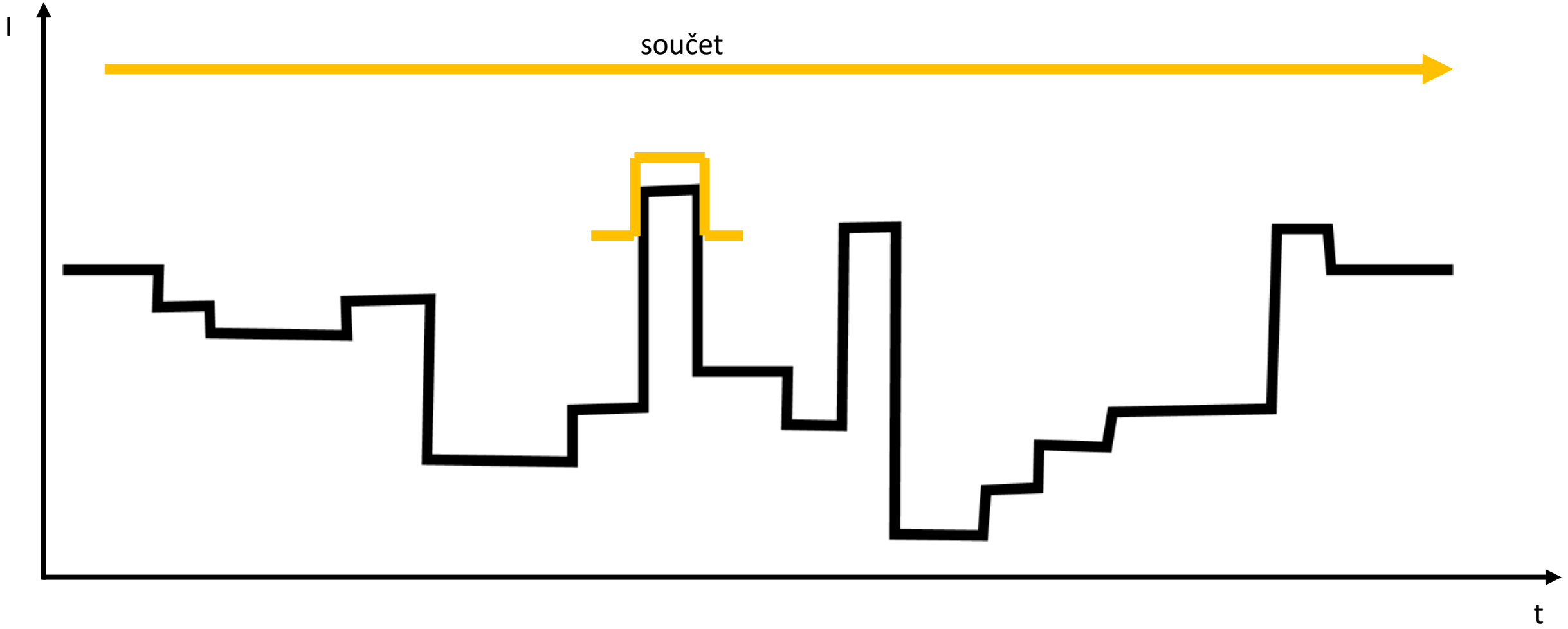
Top-hat transformace



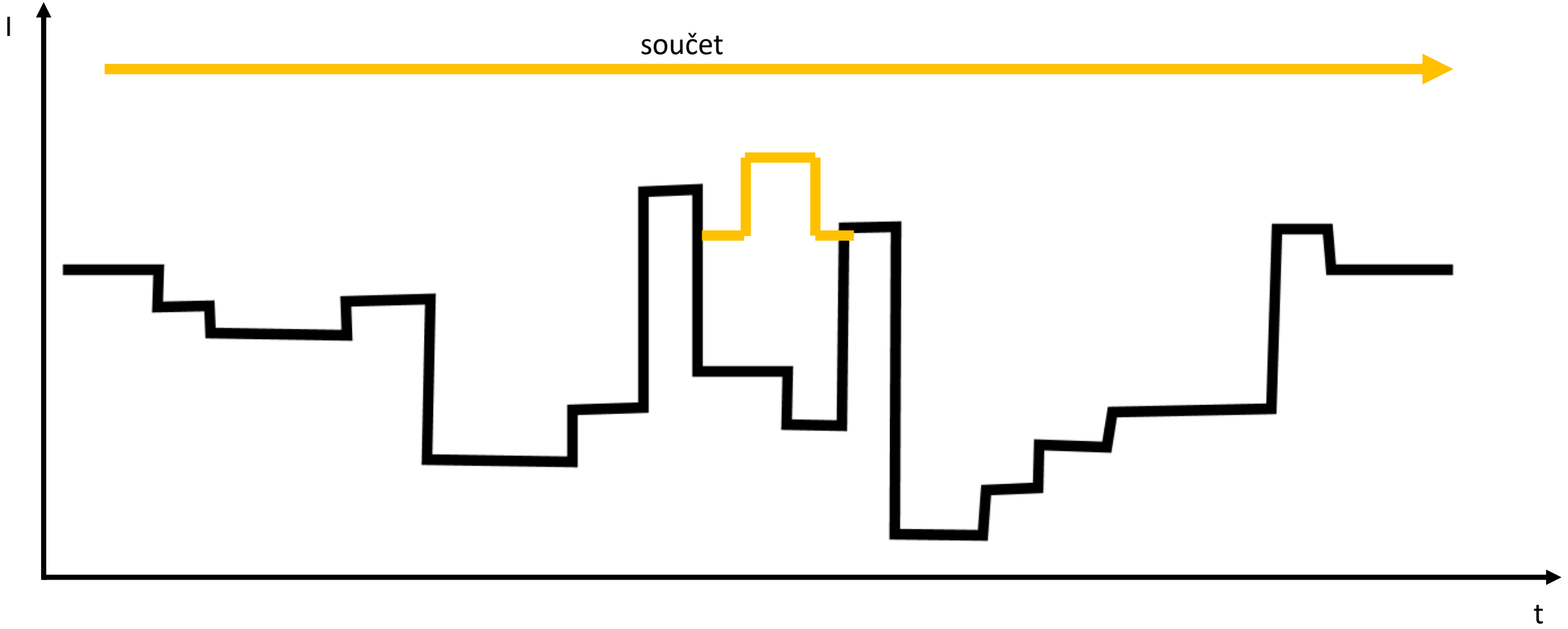
Top-hat transformace



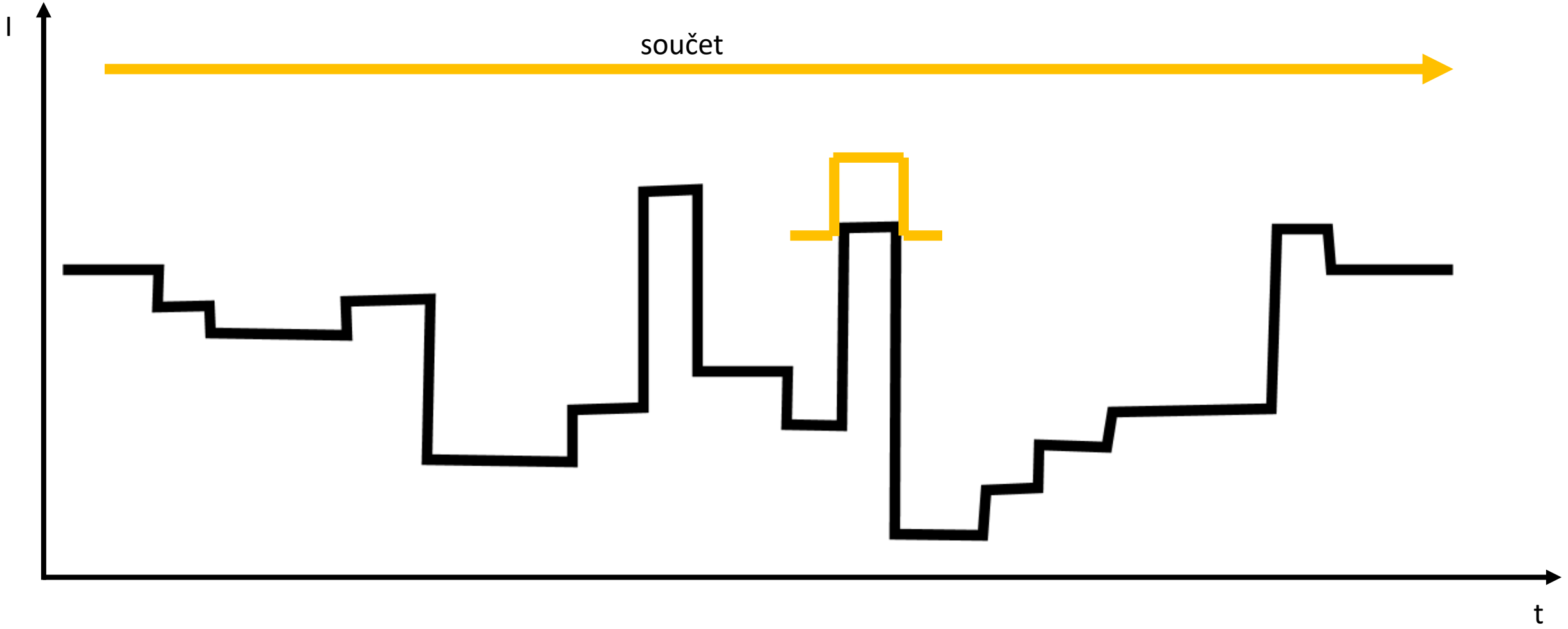
Top-hat transformace



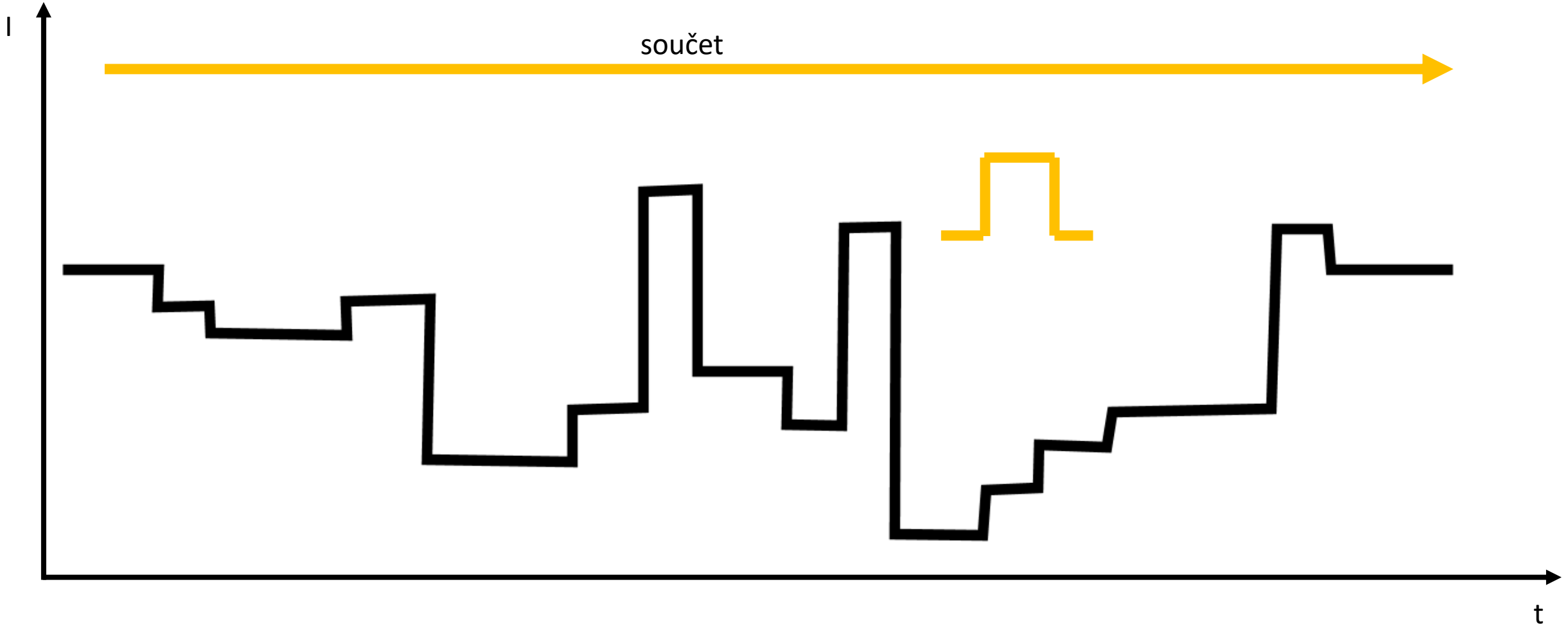
Top-hat transformace



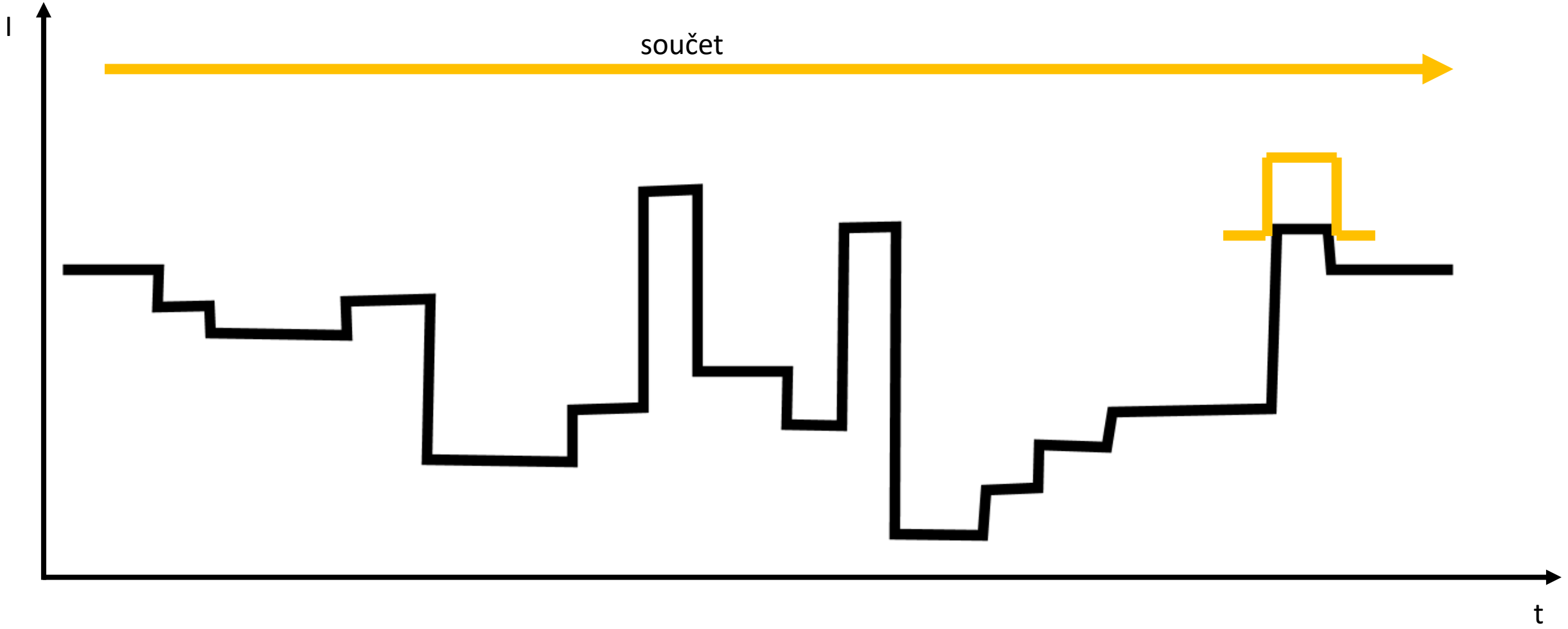
Top-hat transformace



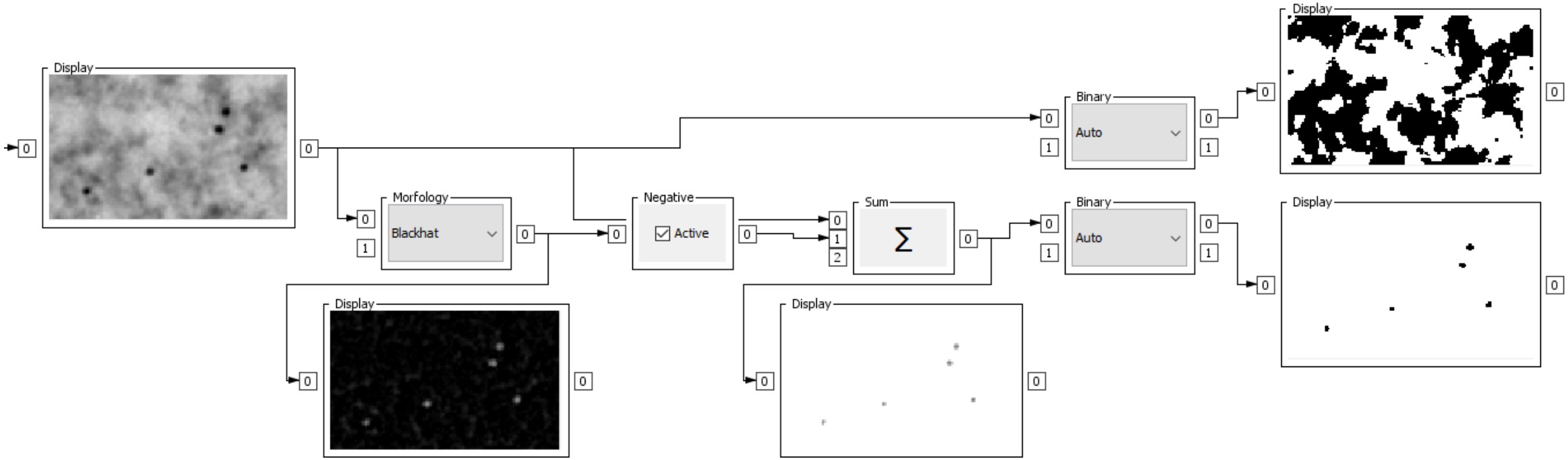
Top-hat transformace



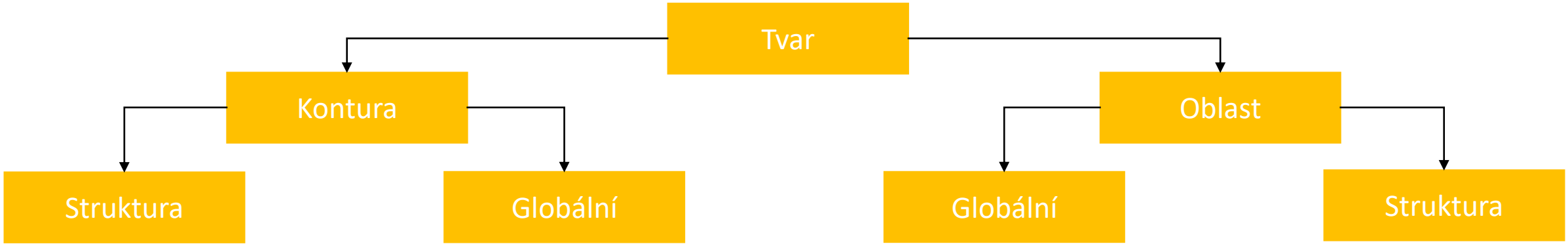
Top-hat transformace



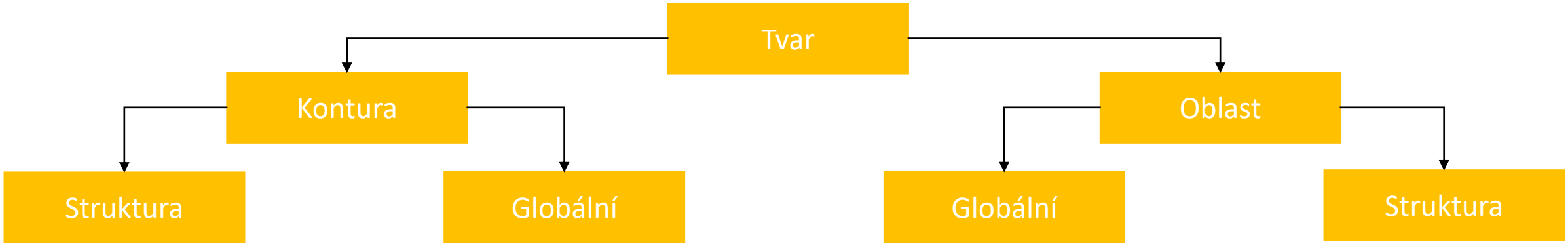
Top-hat / black-hat (bottom-hat)



Tvarové charakteristiky



Tvarové charakteristiky



- Řetezec
- Aproximace křivkou
- Graf

- Convexity (vypouklost)
- Poměr stran
- Fourierovy koeficienty
- Další koeficienty (DCT, WT, KLT)

Tvarové charakteristiky