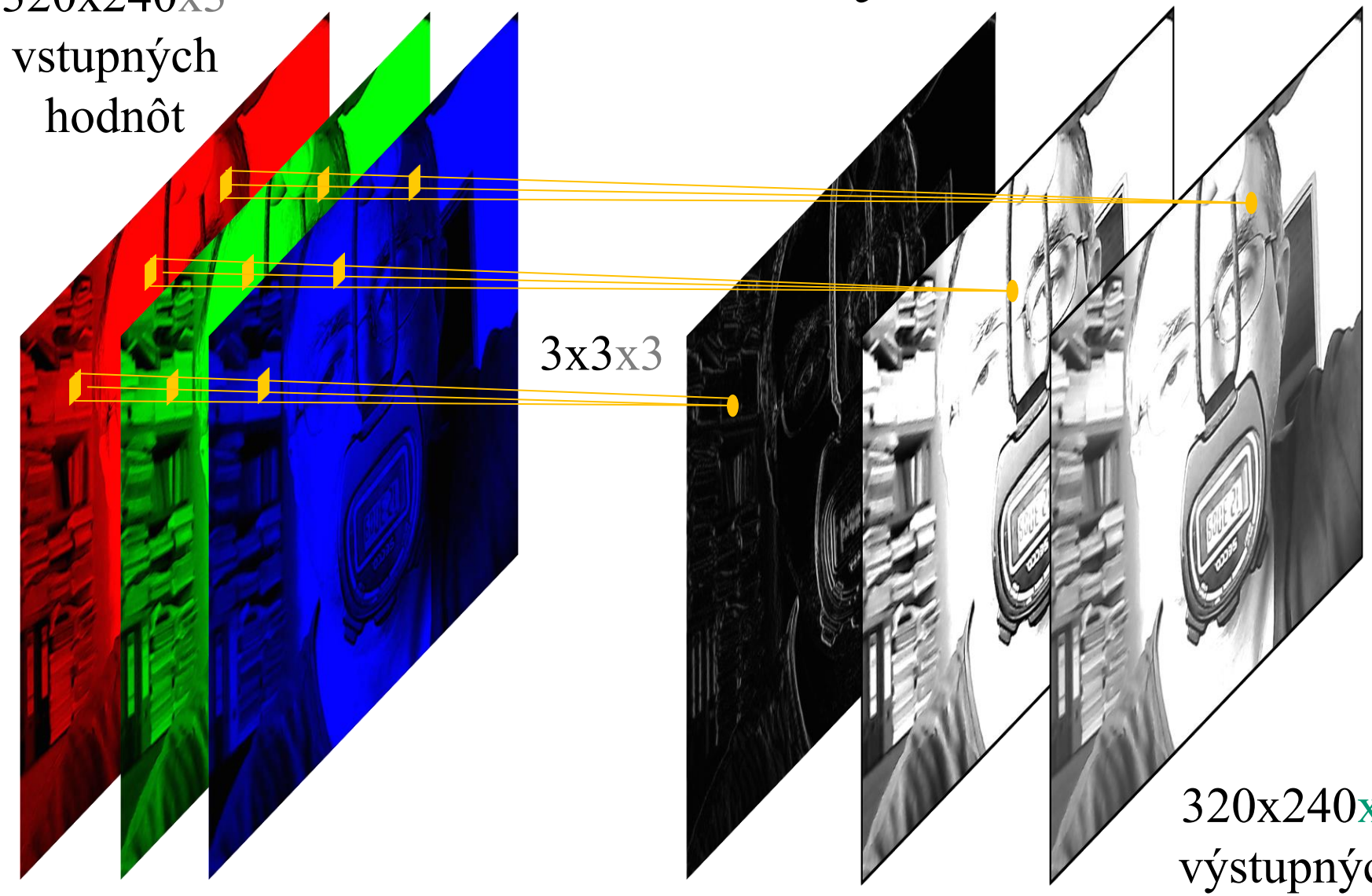
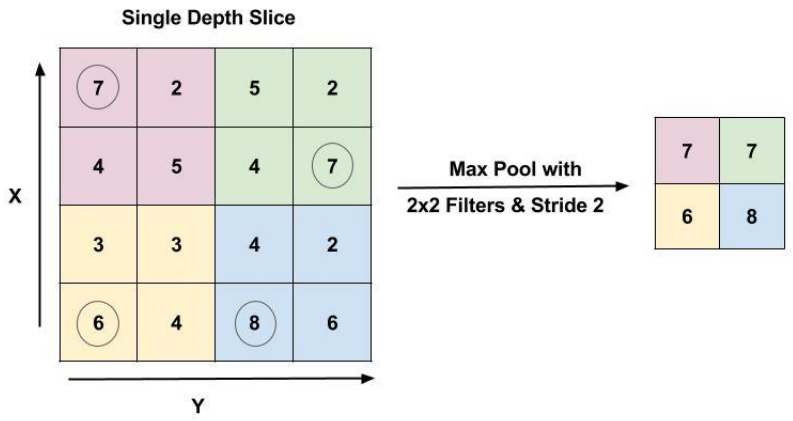
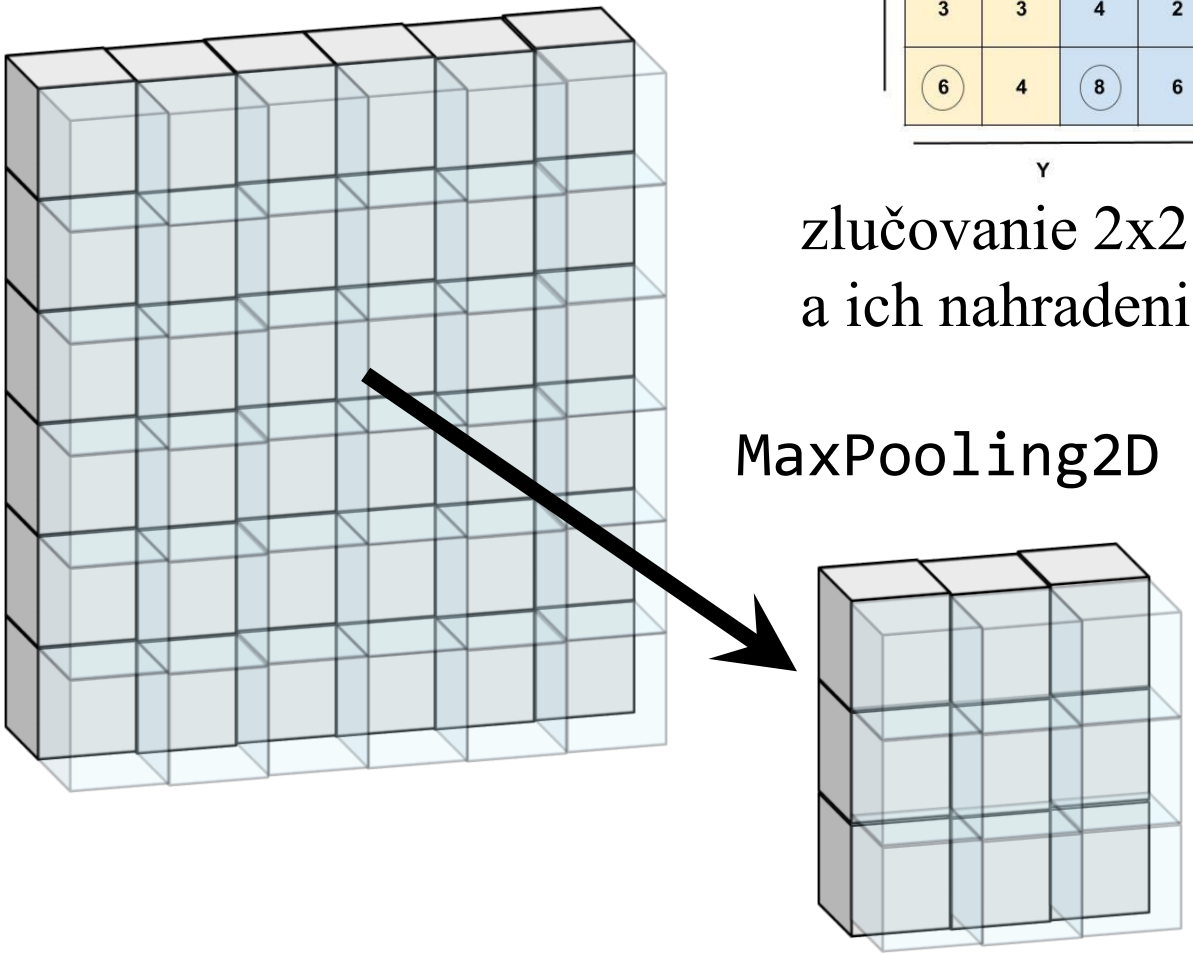
Blok konvolučných vrstiev



Typická aktivačná funkcia: ReLU alebo LeakeyReLU

Redukcia dimenzie na báze maxima

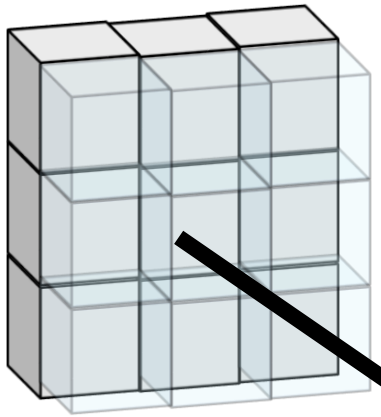


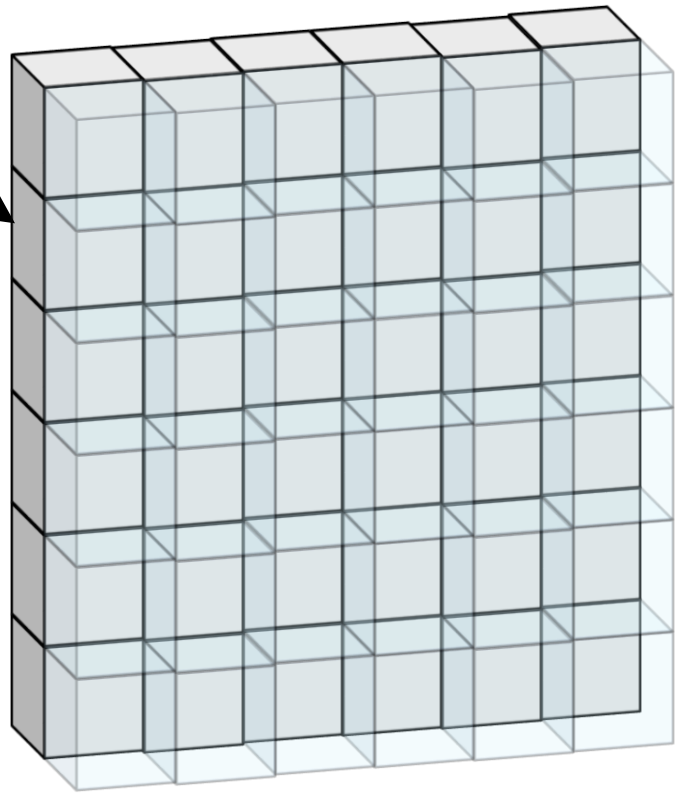


zlučovanie 2x2 pixelov s krokom 2
a ich nahradenie maximom

```
MaxPooling2D 2x2 stride=2
```

Expanzia dimenzie





Nearest Neighbor

1	2
3	4

→

1	1	2	2
1	1	2	2
3	3	4	4
3	3	4	4

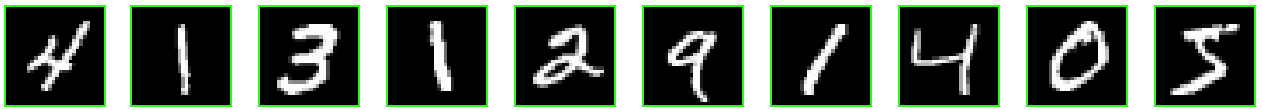
Input: 2 x 2

Output: 4 x 4

`UpSampling2D 2x2 stride=2`

Deap Learning

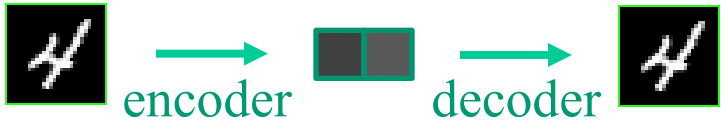
Pracujeme s datasetom obrázkov



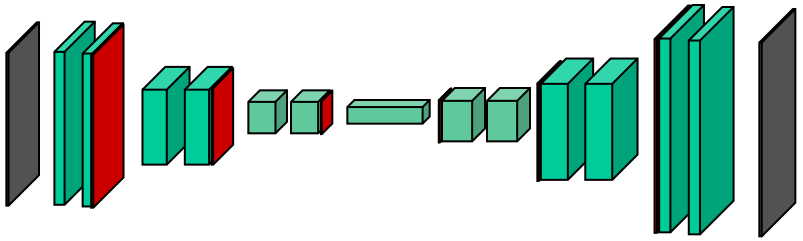
60000 images 28×28

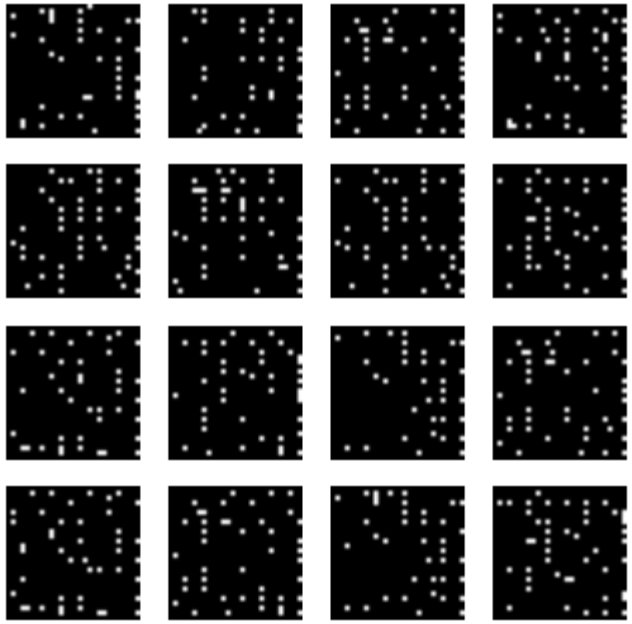
obraz transformujeme na príznaky malej dimenzie

Dobré príznaky vieme nielen zakódovať (extrahovať) ale vieme z nich aj dekódovať (generovať) pôvodný obraz

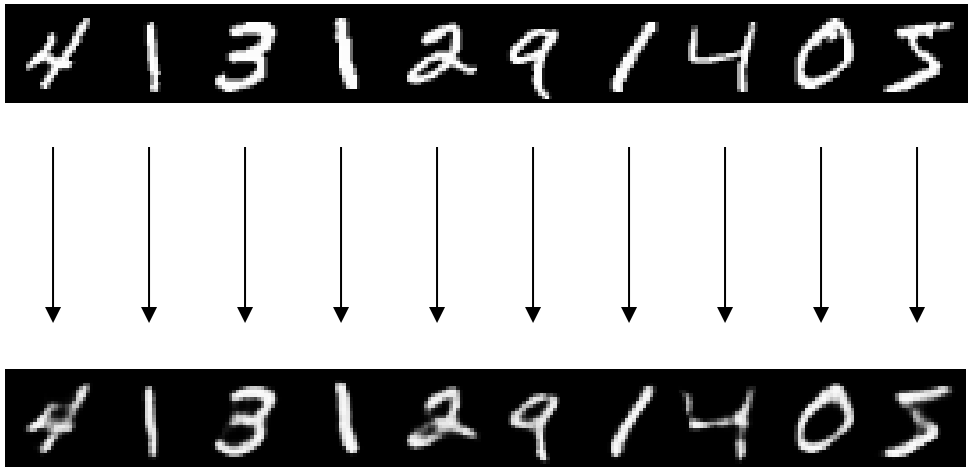


Autoencoder



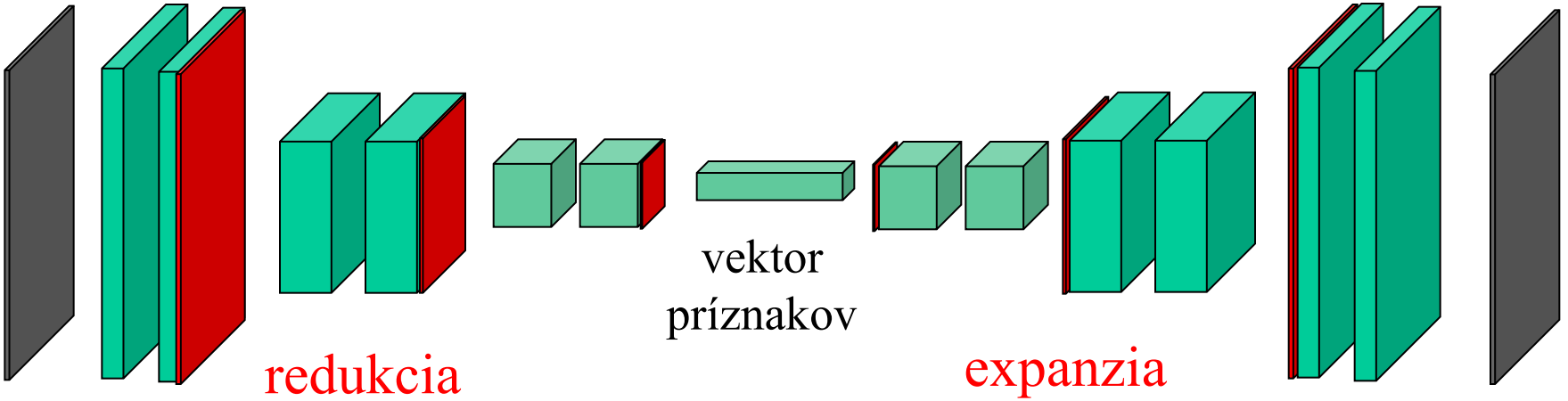


Autoencoder



Dataset MNIST

Konvolučný autokóder

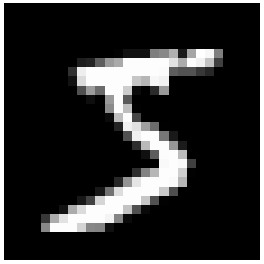


bloky konvolučných vrstiev

chceme, aby:
VSTUP = VÝSTUP

Autoencoder

INPUT

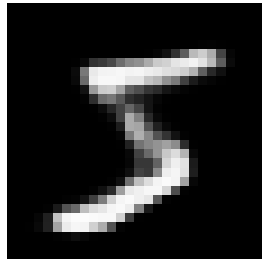


LATENT SPACE

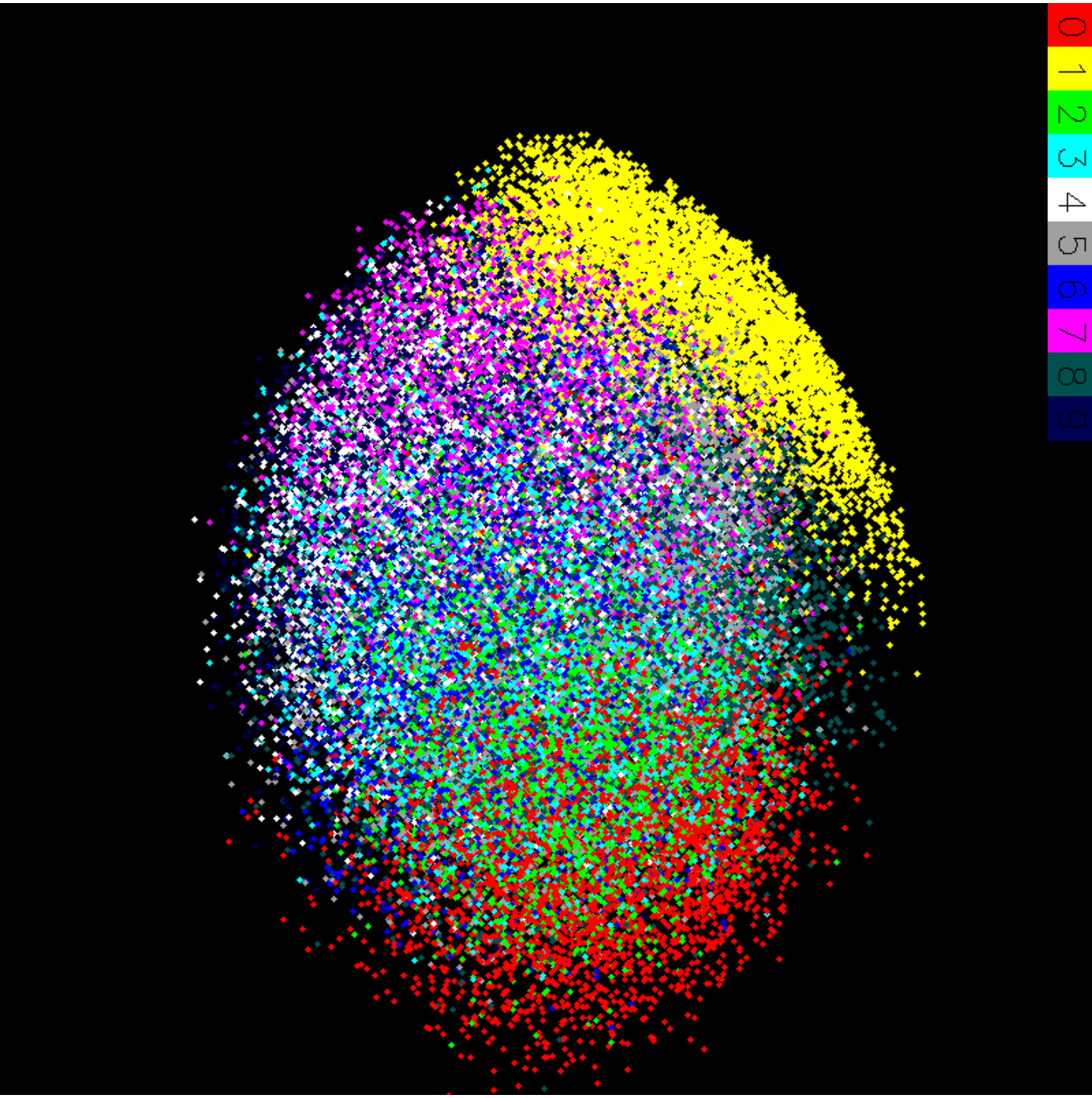
```
array([0.11400187, 0.47539777, 0.19979003, 0.03328802, 0.29702646,
       0.6671412 , 0.77884567, 0.98671937, 0.        , 0.7643514 ,
       0.37023163, 1.1198556 , 0.9364344 , 0.27932528, 1.3840352 ,
       1.1025171 , 0.        , 1.127322  , 0.6720804 , 1.0088537 ,
       0.91483283, 0.        , 1.3498058 , 0.8023532 , 0.13444054,
       1.1076059 , 0.805897  , 0.4363817 , 0.4396257 , 0.        ,
       0.5863744 , 0.41566792, 0.22631842, 0.20689899, 0.28988916,
       0.19635512, 0.92697734, 0.8330982 , 0.8810159 , 0.14809921,
       0.        , 0.20924592, 0.        , 2.7036035 , 1.7514778 ,
       0.84079874, 1.6247051 , 0.        , 0.25012553, 0.70244396,
       0.6414403 , 2.4568624 , 1.4004446 , 0.        , 1.3100656 ,
       0.        , 0.5075829 , 0.68791926, 0.65375787, 0.82646245,
       0.4355916 , 0.        , 0.19816275, 0.        , 0.        ,
       0.4575198 , 0.18170735, 0.12635085, 0.17334037, 0.4582858 ,
       1.0187354 , 0.75260663, 0.        , 0.4846586 , 0.        ,
       1.9696081 , 1.12253   , 0.8872602 , 1.3111267 , 0.        ,
       0.        , 1.1081457 , 0.5976082 , 2.1433632 , 1.2630261 ,
       0.        , 1.4435332 , 0.        , 0.43087044, 0.50078976,
       0.85700417, 0.23156954, 0.3238153 , 0.19322284, 0.23595949,
       0.        , 0.        , 0.11734977, 0.        , 0.8126336 ,
       1.2869604 , 0.65106845, 1.012244  , 0.        , 0.07893795,
       0.16735056, 0.15048887, 2.1369095 , 1.2226689 , 0.        ,
       1.0082622 , 0.        , 0.9999559 , 0.35816067, 0.4425221 ,
       1.7548463 , 0.36668733, 0.25854337, 0.35278222, 0.        ,
       0.7470093 , 0.42634767, 0.5120847 , 0.24160625, 0.23943251,
       0.61216664, 0.171287  , 0.35395604], dtype=float32)
```

features

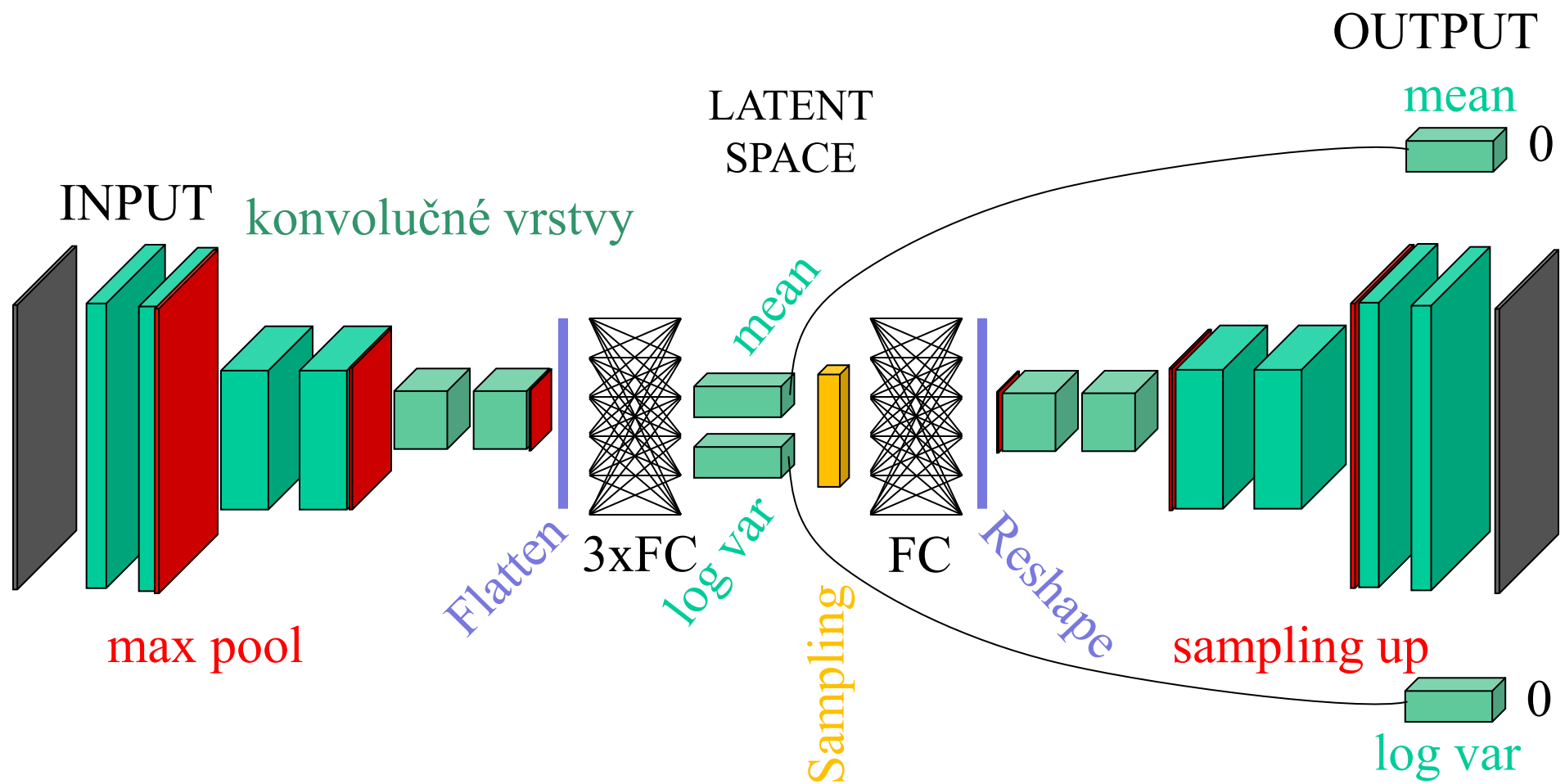
OUTPUT



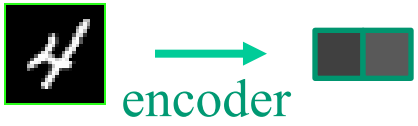
LATENT SPACE

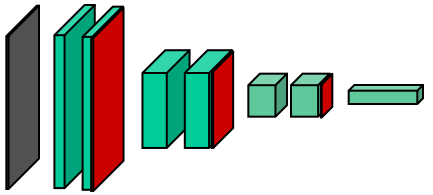


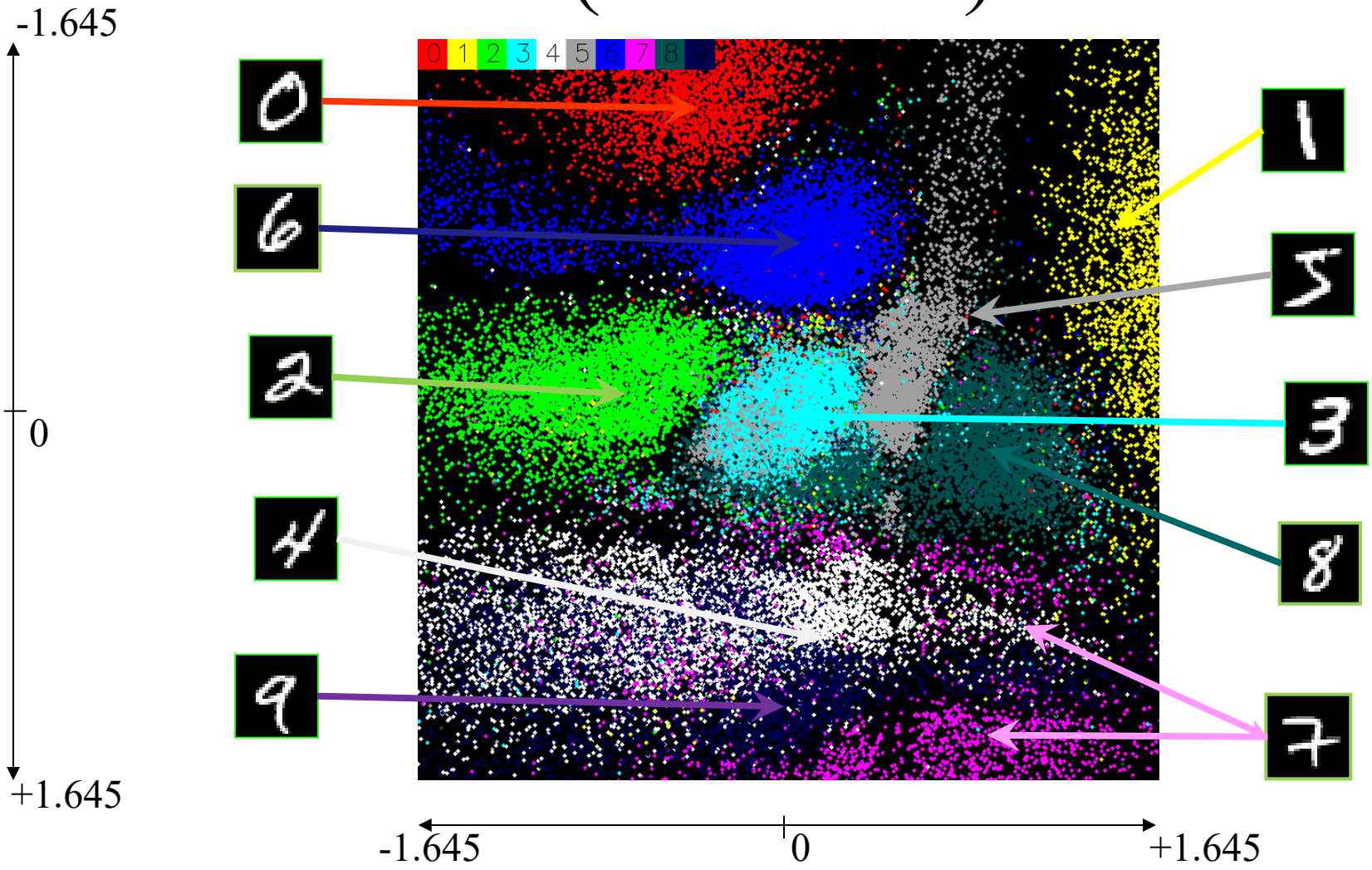
Variational autoencoder



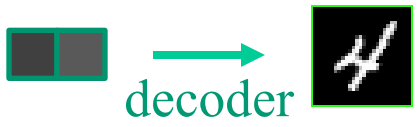
Encoder (Extractor)

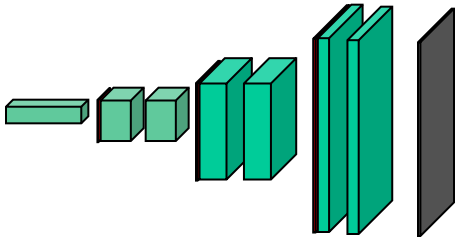


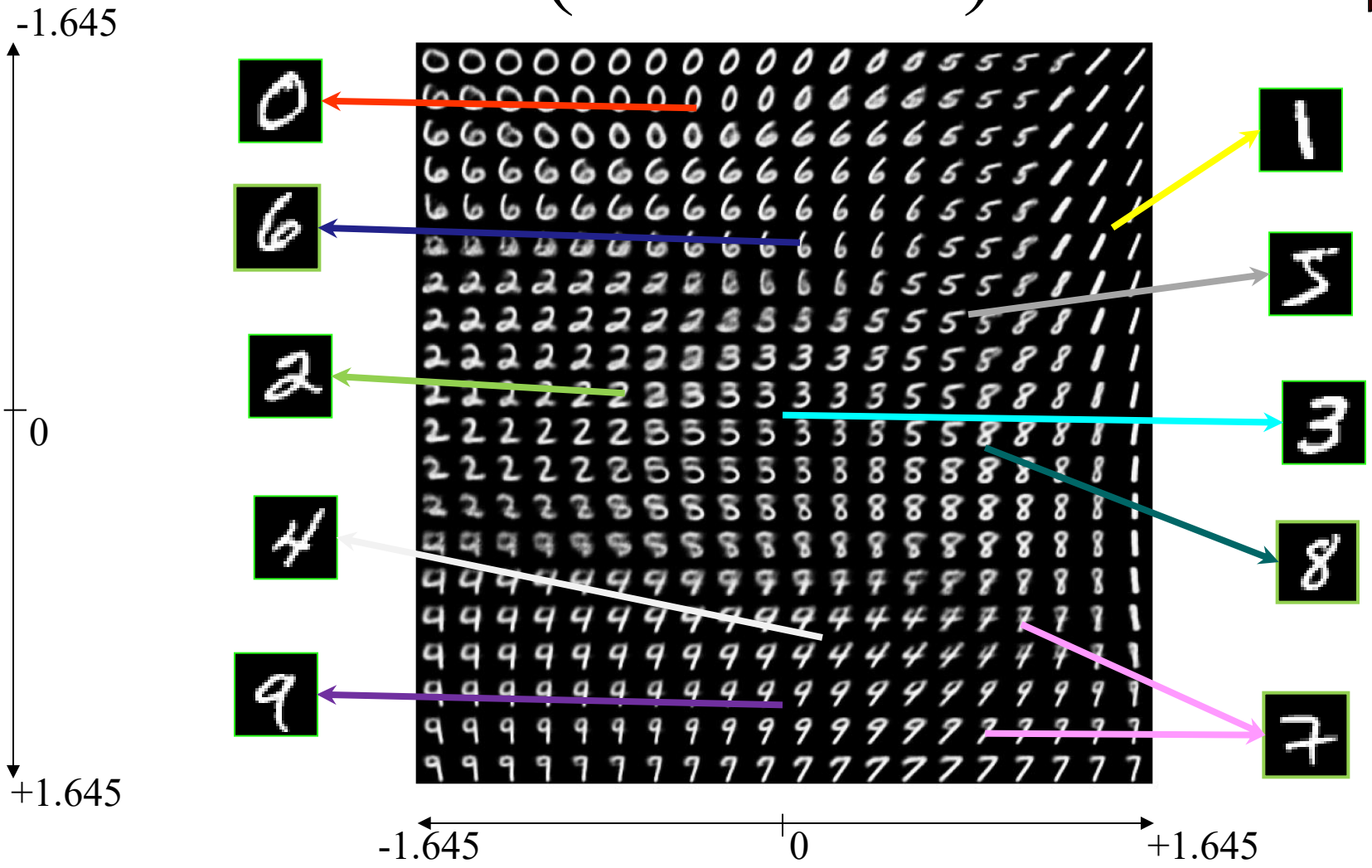




Decoder (Generator)







Základné vlastnosti príznakov

- Príznakové vektory možno zobraziť ako body v latentnom priestore
- Hoci len konečný počet príznakov zodpovedá vzorkám z datasetu, všetky body latentného priestoru zodpovedajú nejakej inštancii dát
- Latentný priestor nemá diery (not sparse) a je plynulý (uniformly continuous)