FYS5429/9429, lecture May 15

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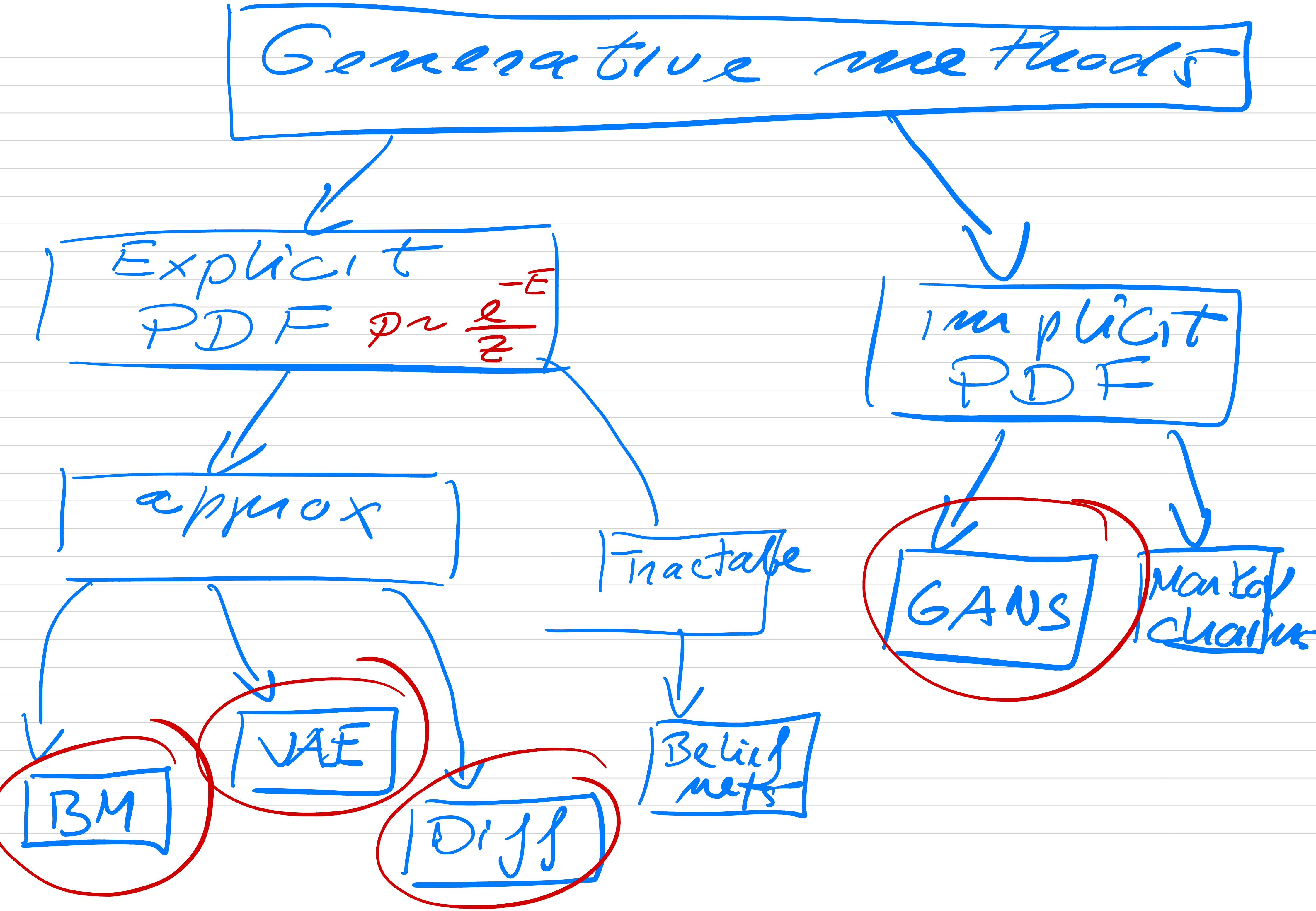
Discriminative methods

- NN
- CNN
- RNN + LSTM
- Autoencoders


Generative methods
Explicit PDF $p \sim \frac{e^{-E}}{Z}$
implicit PDF
approx
Tractable
BM
VAE
Diff
Belief nets
GANS
Markov chains

We want

$$p_\theta(x) = \int_{h \in H} dh \, p_\theta(x, h)$$

$$\tilde{x} \sim p_\theta(x)$$ marginal probability

$$\hat{\theta} = \arg\max_\theta p_\theta(\tilde{x})$$

$$p_\theta(x, h) = p_\theta(x|h) \, p_\theta(h)$$

VAE

Latent space

h
$p_\theta(h)$

$H \leq X$

$\tilde{x} \sim p_\theta(x)$

$p(h|x)$

Decoder
$p_\theta(x|h)$

$p(h|x) \sim q_\phi(h|x)$

X-space

$p_\theta(x) = \int dh \, p_\theta(x|h) \times p_\theta(h)$

Dataset

A typical setting for G and D is a simple NN

G (architecture)

- input-layer, with a 100-dim vector sampled from a Gaussian distribution, latent space. $H \subseteq X$
- Different dense layer
- Reshape layer (784)

D and its architecture

- initial layer receives input (MNIST $\underbrace{28 \times 28}_{784}$)
- hidden layers (reduce dim)
- last layer has one unit with a sigmoid with 0 or 1

0 = fake

1 = real image

Kullback-Leibler divergence

$$D_{KL}(p \| q) = \int_{x \in D} p(x) \log \frac{p(x)}{q(x)} dx$$

$$D_{KL}(p \| q) = 0 \quad \text{if } p(x) = q(x)$$

$$\mathbb{E}_{x \sim p(x)} \left[\log \frac{p(x)}{q(x)} \right]$$

Jensen-Shannon (JS)

$$D_{JS}(p\|q) =$$

$$\frac{1}{2} D_{KL}\left(p \,\Big\|\, \frac{p+q}{2}\right) +$$

$$\frac{1}{2} D_{KL}\left(q \,\Big\|\, \frac{p+q}{2}\right)$$

$$D_{KL}(p\|q) = \int p(x) \log \frac{p(x)}{q(x)} dx$$