

Deep Learning

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Selayang Pandang

① Supervised Learning

- Multilayer Perceptron
- Convolutional Networks
- Recurrent Networks

② Unsupervised Learning

- Representation Learning
- Generative Models

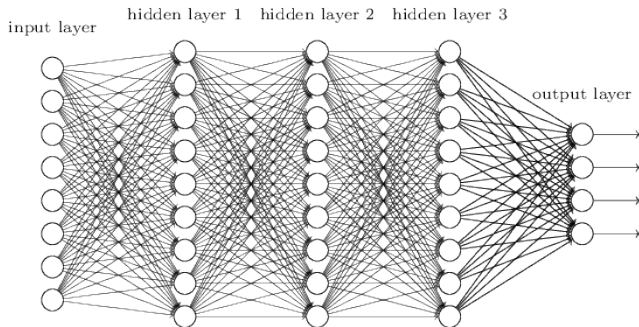
③ Reinforcement Learning

Bahan Bacaan

- 1 Nielsen, M. (2017). *Neural Networks and Deep Learning*. (Chapter 6: Deep learning) <http://neuralnetworksanddeeplearning.com/chap6.html>
- 2 Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT press.
- 3 Schmidhuber, J. (2015). Deep learning in neural networks: An overview. *Neural networks*, 61, 85-117.
- 4 Olah, C. (2015). Understanding LSTM Networks. GitHub blog, posted on August, 27, 2015. <http://colah.github.io/posts/2015-08-Understanding-LSTMs/>

Supervised Learning

Feed Forward



Gambar: Deep learning [Nielsen, 2017]

Acc=98% on MNIST

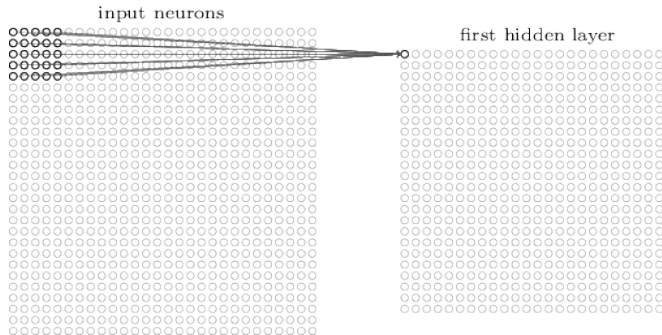
“...to take advantage of the spatial structure”
[Nielsen, 2017]

Convolutional Networks

Poin pengembangan:

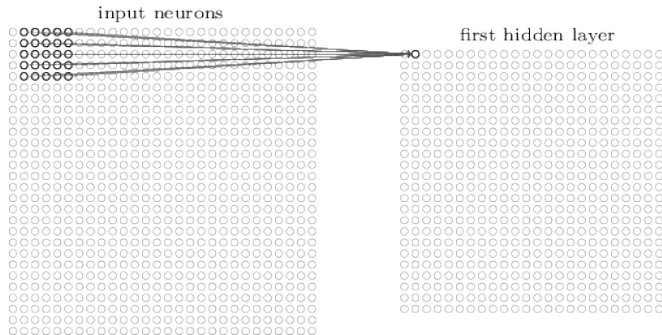
- **Local receptive fields**
- **Weight sharing** \rightarrow *feature maps*
- **Pooling**

Local Receptive Fields



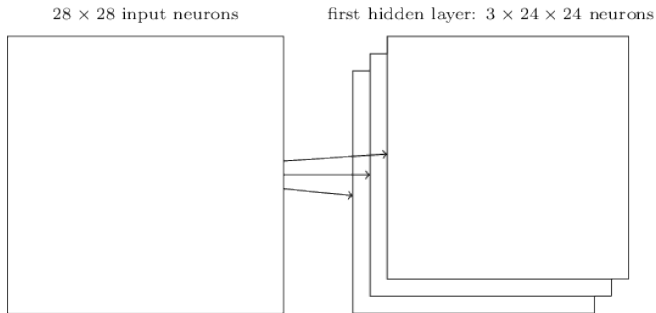
Gambar: *Weight sharing* dengan kernel [Nielsen, 2017]

Local Receptive Fields



Gambar: *Weight sharing* dengan kernel [Nielsen, 2017]

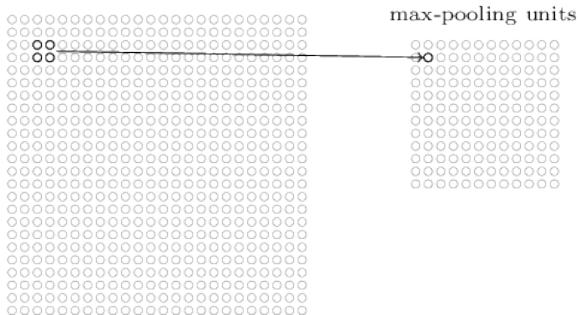
Feature Maps



Gambar: *Shared weight matrix* (kernel) untuk menghasilkan *feature map*
[Nielsen, 2017]

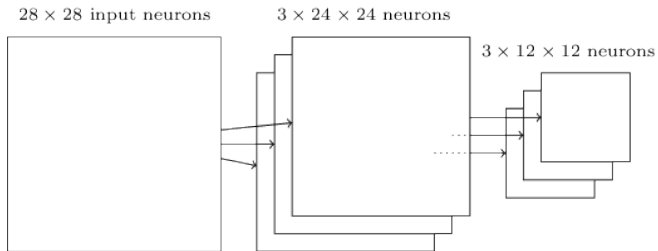
Max-pooling

hidden neurons (output from feature map)



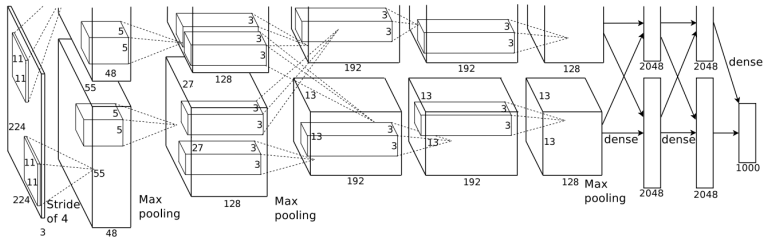
Gambar: Kondensasi (*subsampling*) dengan *pooling* [Nielsen, 2017]

Pooling



Gambar: *Feature maps* hasil pooling [Nielsen, 2017]

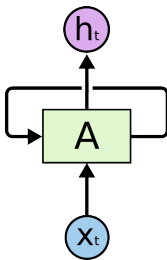
ConvNets



Gambar: AlexNet yang sukses di ImageNet (Krizhevsky, 2012)

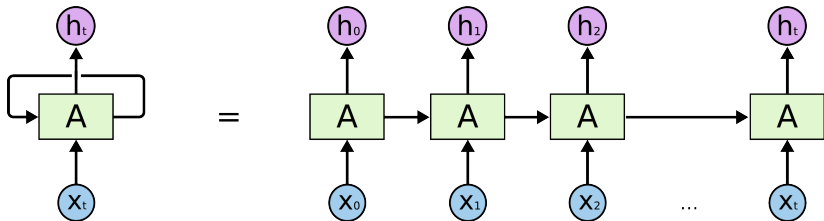
Butuh *temporal-dependence*

Recurrent Neural Networks



Gambar: Looping dalam RNN [Olah, 2015]

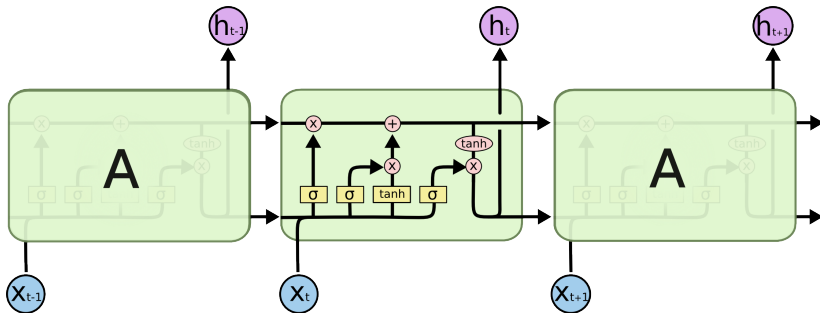
Recurrent Neural Networks



Gambar: RNN dalam sudut pandang sekuensial [Olah, 2015]

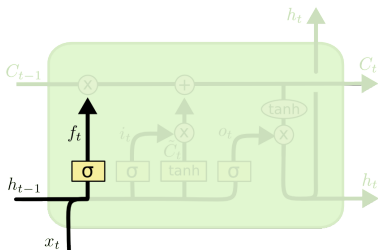
Bermasalah pada saat hubungannya panjang,
e.g. kalimat yang panjang dan kompleks

LSTM



Gambar: Long Short Term Memory networks [Olah, 2015]

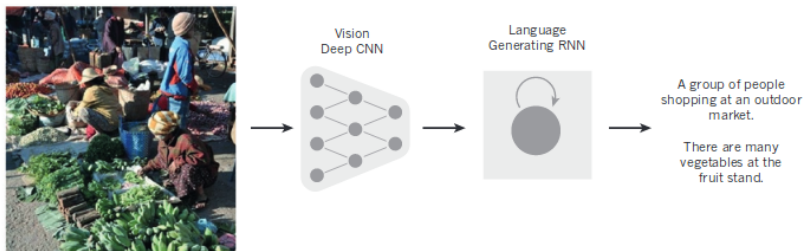
Forget Gate pada LSTM



$$f_t = \sigma(W_f \cdot [h_{t-1}, x_t] + b_f)$$

Gambar: Seberapa banyak informasi yang mau disimpan? [Olah, 2015]

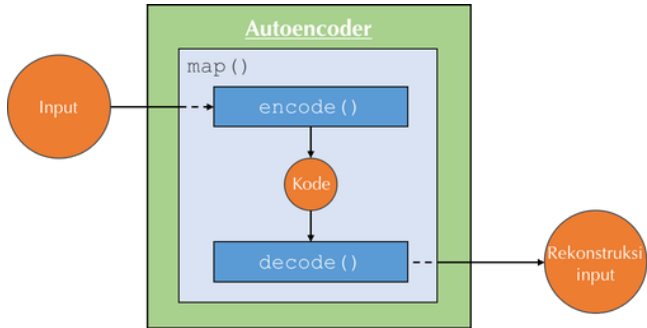
Gabungan CNN-RNN



Gambar: Dapat digabungkan untuk *image captioning* [LeCun et al., 2015]

Unsupervised Learning

Autoencoder



Gambar: Komponen autoencoder

Representasi kode dapat digunakan untuk
mewakili bagian penting data

Denoising Autoencoder

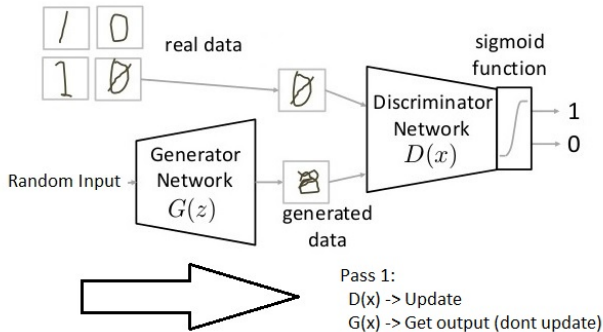


Gambar: Autoencoder untuk mendapatkan representasi gambar lebih baik

Transfer Learning

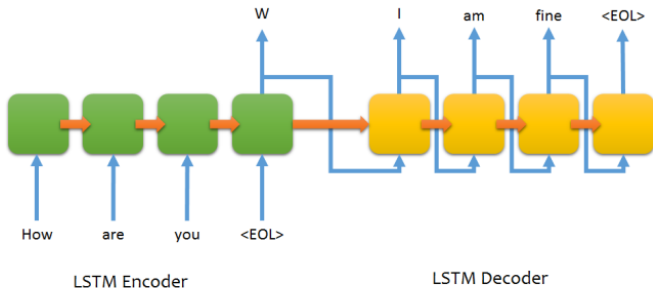
- Representasi dari fitur digunakan untuk masukan *neural networks* lain
- Ekstraksi konten dan representasi “gaya”
- Contoh: VGG-19, ResNet50, InceptionV3, MobileNet

Generative Adversarial Networks (GANs)



Gambar: Pemalsu vs detektif dalam GANs

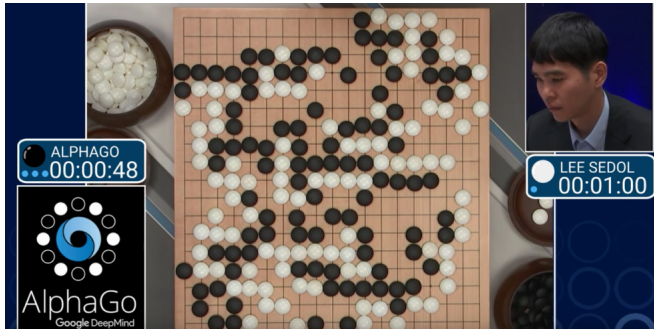
Seq2Seq



Gambar: Sequence-to-sequence (Seq2Seq) untuk QA

Reinforcement Learning

Deep Reinforcement Learning



Gambar: AlphaGo yang memanfaatkan CNN dan NN untuk memilih *policy*

MCTS

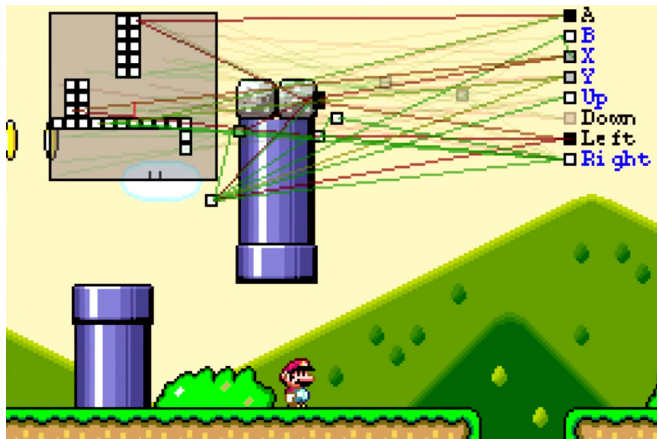


Gambar: Monte-Carlo Tree Search pada AlphaGo

Learning from Scratch



Gambar: AlphaGo Zero belajar dengan *self-playing*



Gambar: NeuroEvolution of Augmenting Topologies (NEAT)

Kuliah Terkait

- Stanford CS231n: Convolutional Neural Networks for Visual Recognition
- Stanford CS224n: Natural Language Processing with Deep Learning
- Oxford Deep NLP

Referensi



Michael Nielsen (2017)

Neural Networks and Deep Learning

<http://neuralnetworksanddeeplearning.com/chap6.html>



Chris Olah (2015)

Understanding LSTM Networks

<http://colah.github.io/posts/2015-08-Understanding-LSTMs/>



Yann LeCun, Yoshua Bengio, Geoffrey Hinton (2015)

Deep Learning

Nature, 521(7553), 436-444

Terima kasih