Review Series of Recent Deep Learning Papers:

Parameter Prediction Paper: Dynamic Filter Networks

Bert De Brabandere, Xu Jia, Tinne Tuytelaars, Luc Van Gool

NIPS 2016

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https://qdata.github.io/deep2Read/

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Motivation

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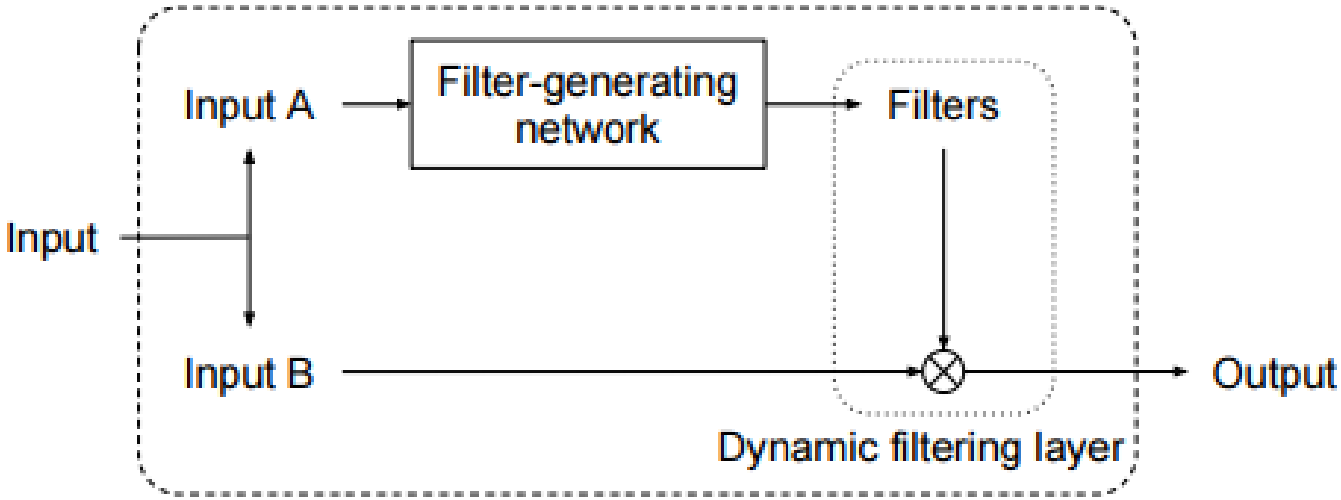
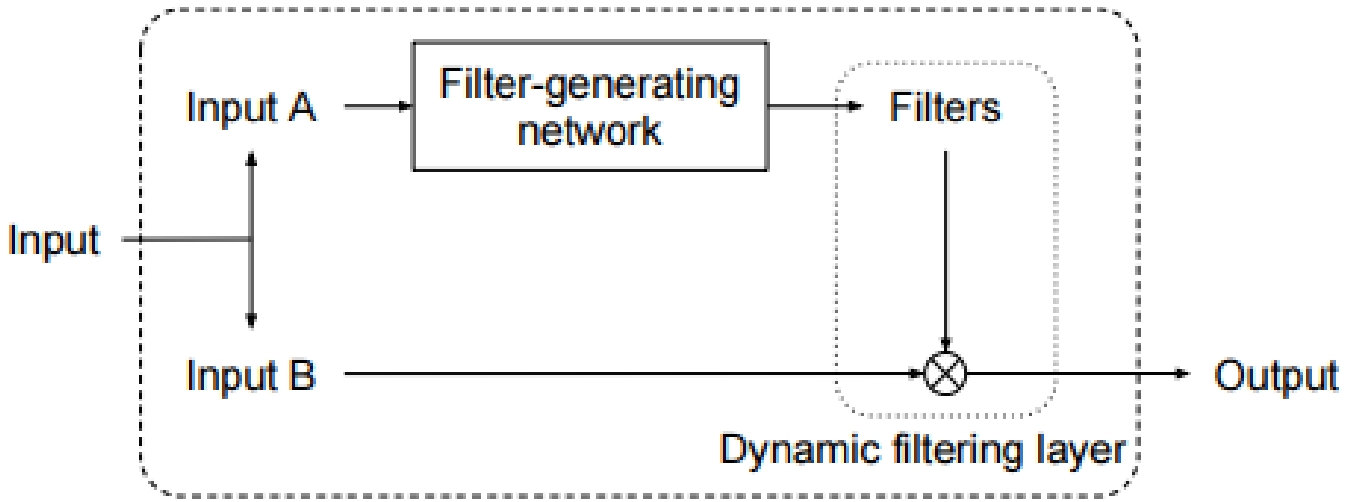
2. Given a video frame humans can predict the next frame
3. Deep Networks trained for the same tasks use the same trained filtering operation for all samples.
4. But, for example in a video frame prediction, different videos may have different motion patterns.
5. Dynamic filters for flexibility : filters conditioned on some input.

Dynamic Filter Network



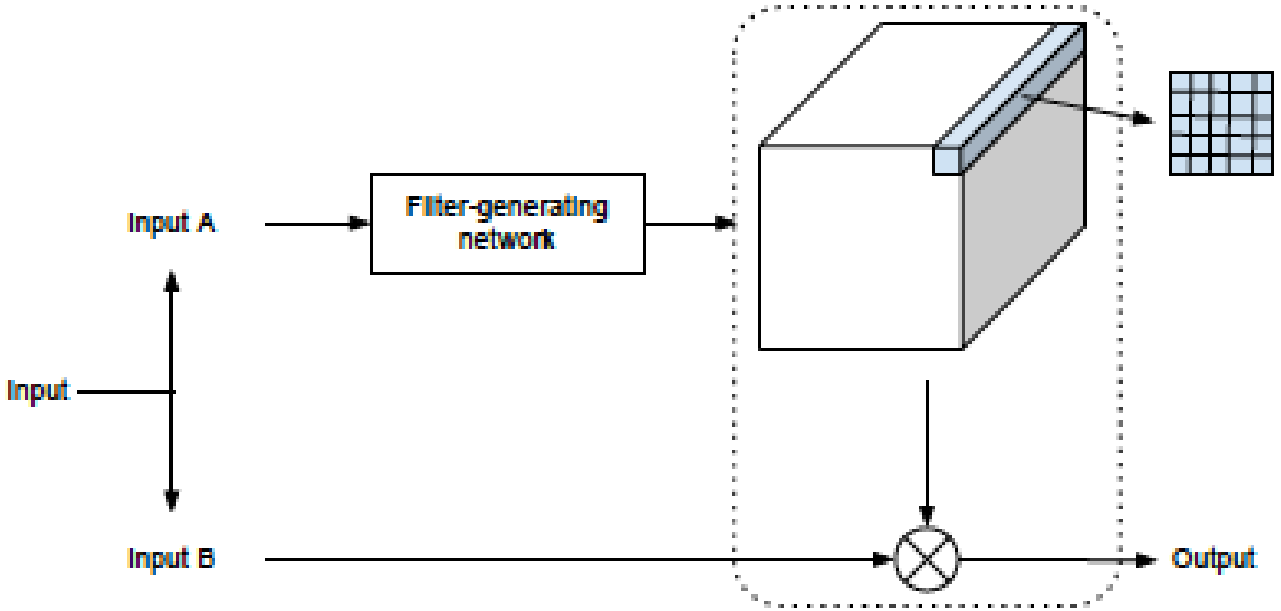
1. *Filter Generating Network* generates filter conditioned on Input A
2. *The Dynamic Filtering Layer* applies it to Input B
3. Input A and B may be the same or different

Filter Generating Network



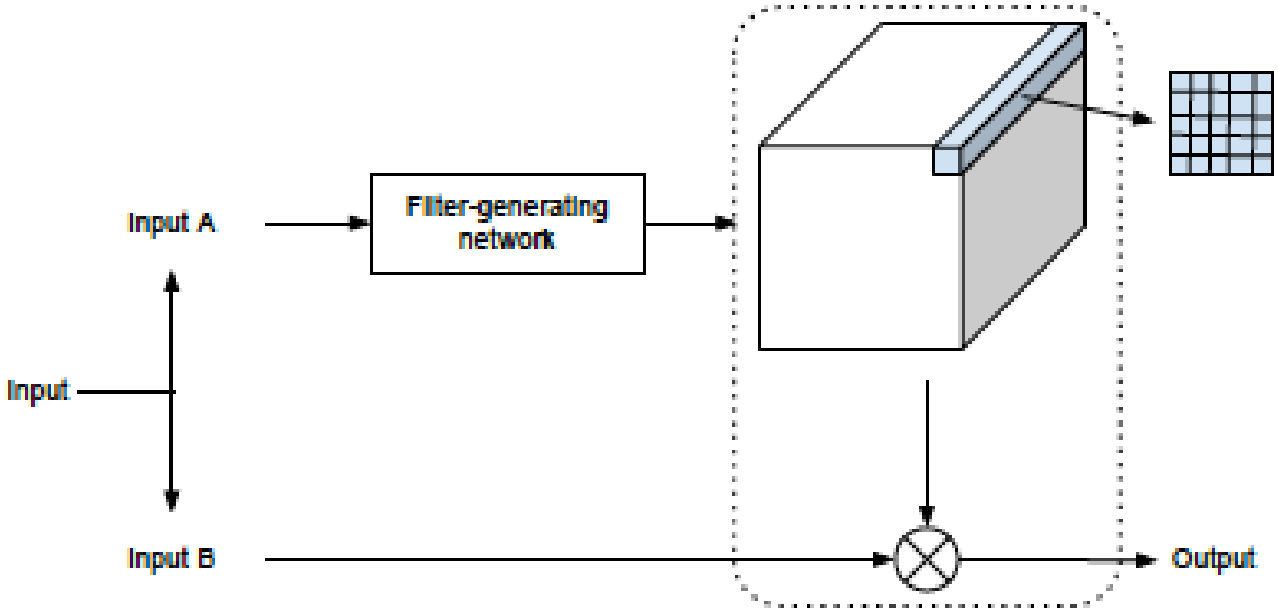
1. Input A $\mathbb{R}^{h \times w \times c_A}$
2. Input B $\mathbb{R}^{h \times w \times c_B}$
3. Generated n Filters F_θ parameterized by $\theta \epsilon \mathbb{R}^{s \times s \times n \times c_B}$ if c_B is the number of channels in Input B

Dynamic Local Filtering Layer



Filters are not same for all spatial locations.
Generated Filters vary for positions on the image
Generated Filters $F_\theta^{(i,j)}$ where $\theta \epsilon \mathbb{R}^{s \times s \times n \times c_B \times h \times w}$ if c_B is the number of channels in Input B
Helps to model local position specific transformation

Dynamic Local Filtering Layer



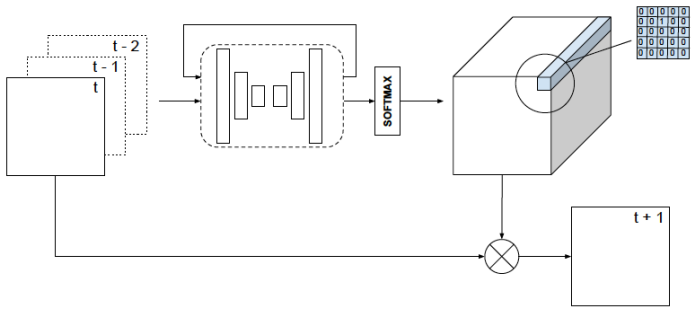
If I_A and I_B are both images, use a CNN for the fiter generating network.

Generated Filters conditioned on corresponding positions in I_A.

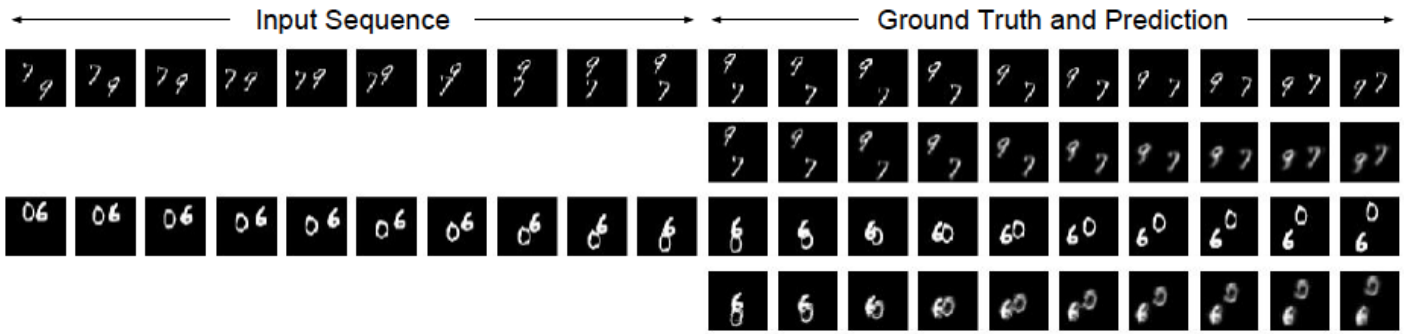
$$G(i,j) = F_\theta^{(i,j)}(I_B(i,j))$$

Results: Video Prediction

1. Task: predict next frame given a sequence of video frames



Model for Video Prediction



Synthetic moving MNIST

Model	Moving MNIST # params	Moving MNIST bce
FC-LSTM [19]	142,667,776	341.2
Conv-LSTM [18]	7,585,296	367.1
Spatio-temporal [15]	1,035,067	179.8
Baseline (ours)	637,443	432.5
DFN (ours)	637,361	285.2

Results: Moving MNIST dataset