

# Advanced Topics in Machine Learning – Assignment # 4 Universität Bern

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**Due date: 02/05/2017**

**In this assignment you need to upload a zip file to ILIAS which includes: 1) assignment4.lua file and 2) a pdf of your answers to the questions (see next page). The zip file name must be FirstName\_LastName.zip. If your implementation requires auxiliary functions, you must implement that function inside the corresponding .lua file.** We prefer pdf format (over docx) because it is universally supported on all platforms. Please also indicate your name on top of the first page in your pdf submission. Please do not print or display anything in the code (comment it out before submission).

**Maximum grade: 4 Points**

1. Answer the following questions.

- **[0.5 point]** What are the main motivations of using Convolutional Neural Networks (CNN)?
- **[0.5 point]** Why do we need regularization in machine learning? Give two examples of regularization in deep learning.

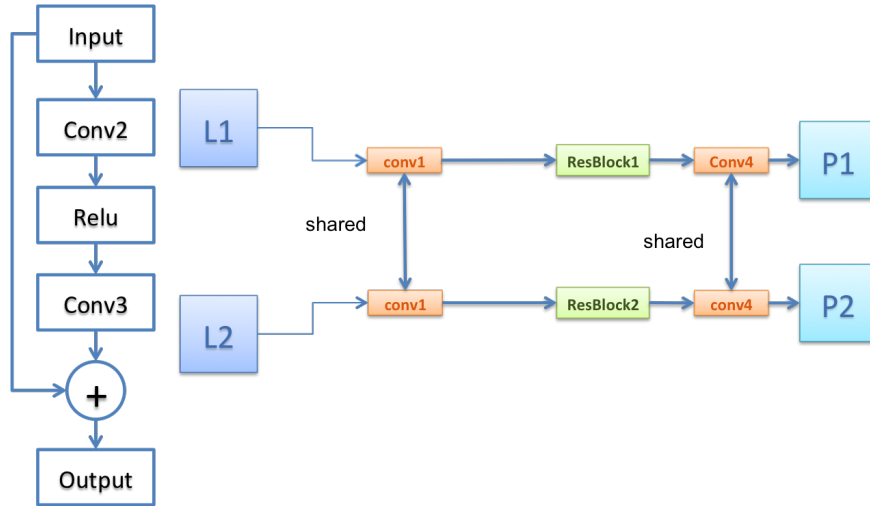


Figure 1: Left: Residual block. Center-Right: Main network (where the residual blocks must be integrated).

2. **[3 points]** In this exercise, you need to use torch to implement a CNN with two shared layers (*conv1* and *conv4*) as shown in Fig. 1. The vertical graph on the left in the Figure shows a residual block. You need to implement this residual block and integrate it in the main network (the graph on the right in the Figure – blocks L1 and L2 to blocks P1 and P2). In the main network, there are two inputs noted as L1 and L2. *conv1*, *conv2* and *conv3* refer to the convolution layers with receptive field  $3 \times 3$  and 32 filters. *conv4* also has receptive field  $3 \times 3$  but with only 3 filters. Every convolution layer preserves dimensions with zero padding, such that output P1 and P2 have the same size as L1 and L2. In the provided lua file, you need to finish the “**TODO**” parts. To check whether the network is properly designed, we provide the code for training the network and extracting parameters. **Please do not remove the training code.** If your network design is correct, the output of the lua file should be 0.