# Tutorial 7
# Convolutional Neural Networks II

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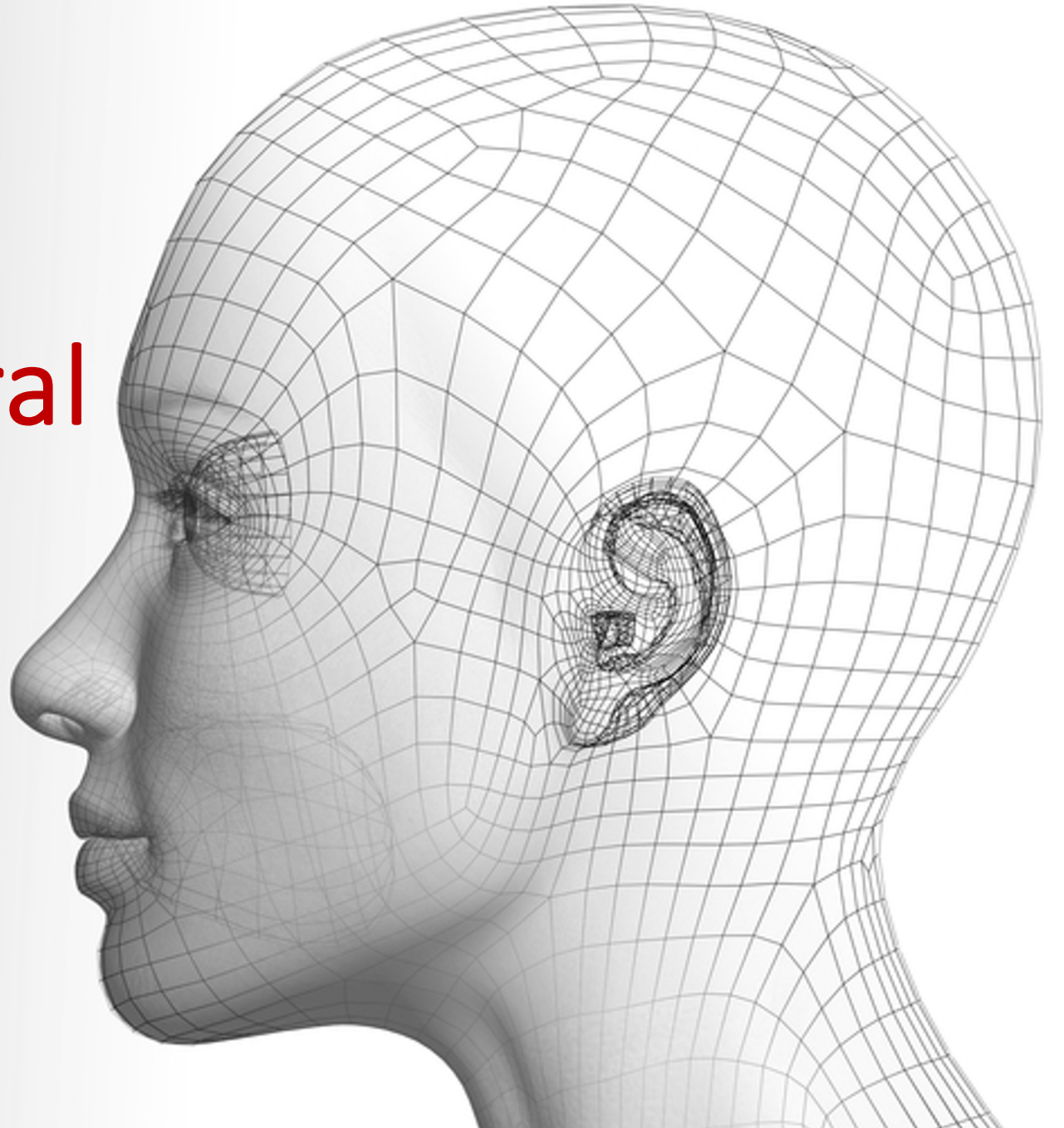
# Reminder: Feedback on Teaching

Dear Student,

The Online Faculty Teaching Evaluation for Semester 2 AY23-24 is now open.

Please [click here](click here) to provide the feedback. The link is valid from 11-MAR-2024 to 24-MAR-2024.

We would like to strongly encourage you to participate in this exercise. Giving teaching feedback to the School will benefit the student population as we work towards refining and improving our teaching pedagogy and course materials. Together we can develop a more nurturing and effective learning environment for every student.
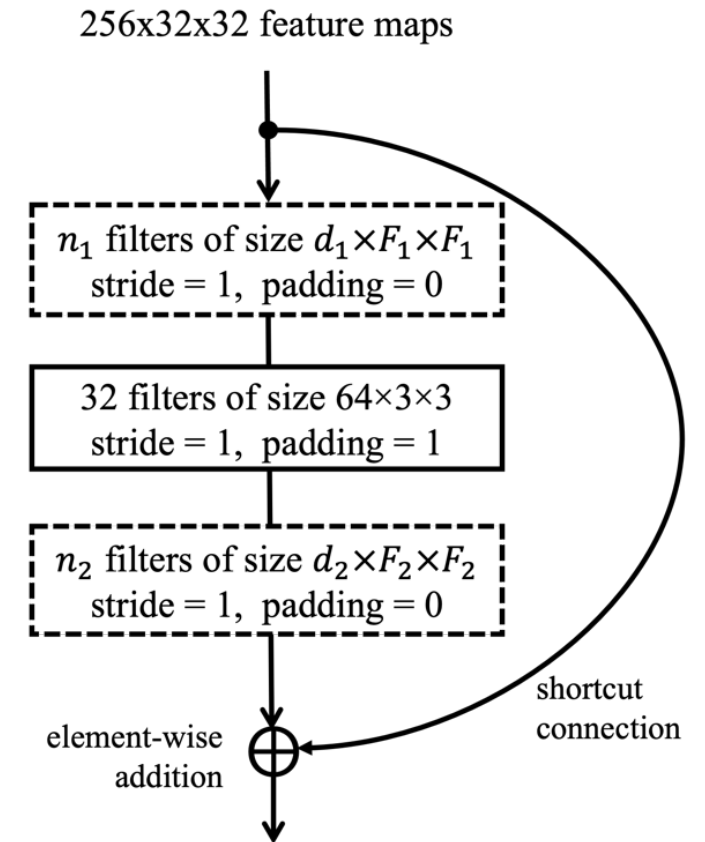
Thank you and with Best Regards,

SFT Administrator

# Question 1

Figure Q1 depicts a block that consists of three convolutional layers. The input volume has a size of $256 \times 32 \times 32$ and the second layer has 32 convolution filters each with a size of $64 \times 3 \times 3$, stride = 1 and padding = 1.

Provide the values of $n_1$, $d_1$, $F_1$, $n_2$, $d_2$, and $F_2$ to form a valid block. Explain your design

Answer is hidden so that you can try the question by yourself first

256x32x32 feature maps

$n_1$ filters of size $d_1 \times F_1 \times F_1$
stride = 1, padding = 0

32 filters of size $64 \times 3 \times 3$
stride = 1, padding = 1

$n_2$ filters of size $d_2 \times F_2 \times F_2$
stride = 1, padding = 0

shortcut
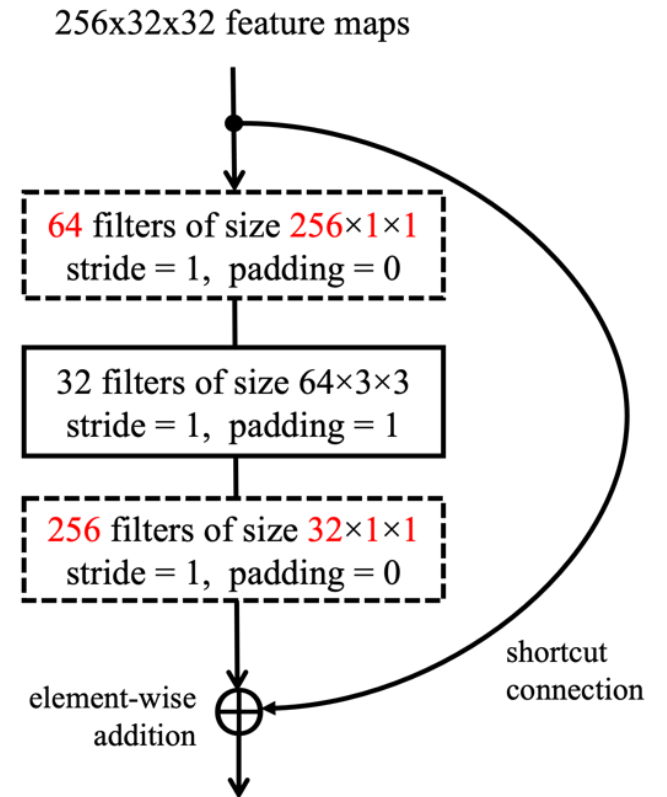connection

element-wise
addition

**Figure Q1**

# Question 1

**Answer:**

$n_1 = 64, d_1 = 256, F_1 = 1$

$n_2 = 256, d_2 = 32, F_2 = 1$

To form a valid block, the size the of output volume at the residual branch has to be the same size as the input volume, which is 256×32×32, such that element-wise addition can be performed, thus $n_2 = 256$ and 1×1 is chosen to keep the spatial resolution.
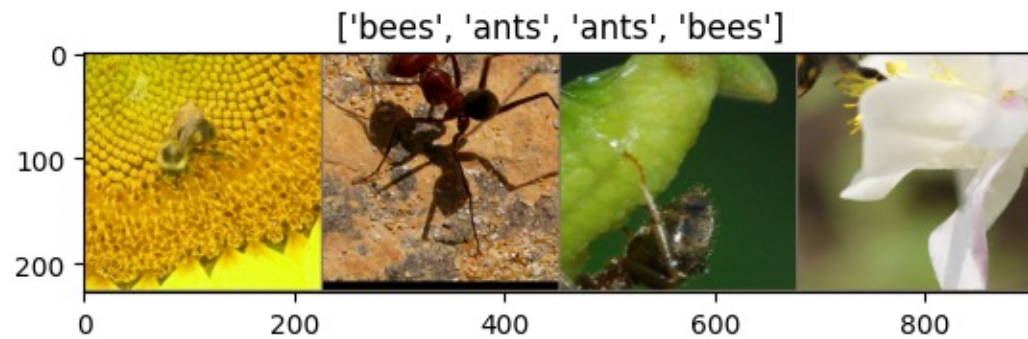
The values of $d_1$ and $d_2$ are chosen to match the depth of their corresponding input. $n_1$ is chosen to match the filter size of the second layer.

256x32x32 feature maps

64 filters of size 256×1×1
stride = 1, padding = 0

32 filters of size 64×3×3
stride = 1, padding = 1

256 filters of size 32×1×1
stride = 1, padding = 0

element-wise addition

shortcut connection

# Question 2

Study and try the tutorial t7q2.ipynb on transfer learning. In particular,
- Understand how to data augmentation is performed
- Review the transfer learning steps
- Try the code to perform transfer learning on the classification of bees vs. ants



*Check the code for more details*