Neural networks
Computer vision - local connectivity
Topics: computer vision

• We can design neural networks that are specifically adapted for such problems
  ‣ must deal with very high-dimensional inputs
    - 150 x 150 pixels = 22500 inputs, or 3 x 22500 if RGB pixels
  ‣ can exploit the 2D topology of pixels (or 3D for video data)
  ‣ can build in invariance to certain variations we can expect
    - translations, illumination, etc.

• Convolutional networks leverage these ideas
  ‣ local connectivity
  ‣ parameter sharing
  ‣ pooling / subsampling hidden units
Topics: local connectivity

• First idea: use a local connectivity of hidden units
  ‣ each hidden unit is connected only to a subregion (patch) of the input image
  ‣ it is connected to all channels
    - 1 if greyscale image
    - 3 (R, G, B) for color image

• Solves the following problems:
  ‣ fully connected hidden layer would have an unmanageable number of parameters
  ‣ computing the linear activations of the hidden units would be very expensive

\[ r \] = receptive field
Topics: local connectivity

- Units are connected to all channels:
  - 1 channel if grayscale image, 3 channels (R, G, B) if color image