# Formatting instructions for NIPS 2016

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## Abstract

Ganz tolles Abstract

## 1 Questions

### 1.1 1

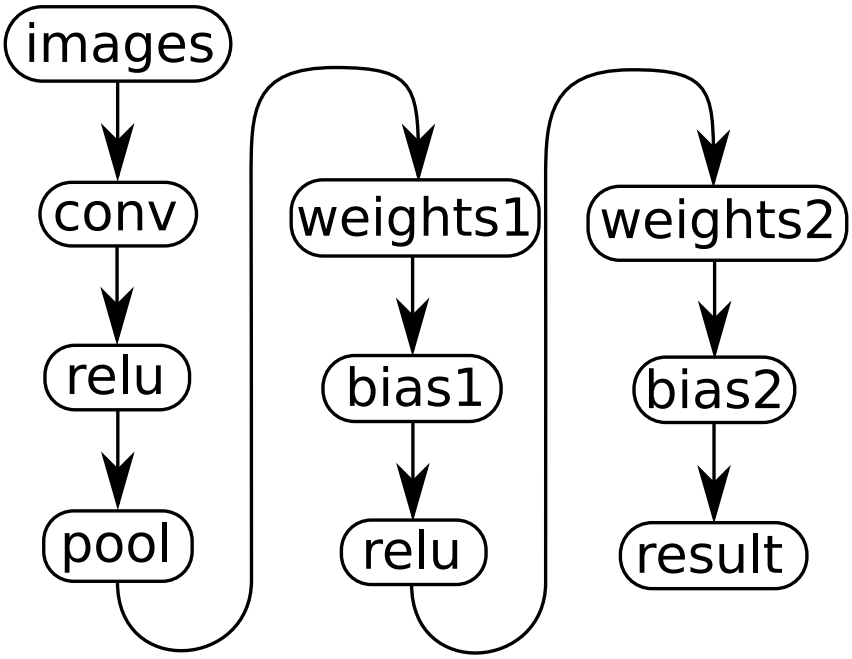


Figure 1: The network

Figure 1 describes the architecture of our CNN. We chose a small and therefore fast to train network, while still achieving high accuracy. We also tried larger networks through adding another conv-relu-pool layer and more hidden layers, with no improvement in accuracy but an increase in training time. The ReLu activation function was chosen because it performed better than tanh activation function.

### 1.2 2

The CNN was trained with standard parameters using softmax regression (`tf.nn.softmax_cross_entropy_with_logits`). This method applies a softmax nonlinearity to the output of the network and calculates the cross-entropy between the normalized predictions and a 1-hot encoding of the label. Various Optimizers were tested, with the Adam-

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Figure 2: learning rate

Optimizer converging faster and to a higher accuracy compared to Momentum-Optimizer and Gradient-Descent-Optimizer.

### 1.3 3

### 1.4 4

No. While running solely on a CPU, setting the seed parameter for otherwise randomized initializations will give the same result for each run. The MNIST loader, which randomizes the batches per default, can be seeded via `np.random.seed`, while `tf.truncated_normal` and `tf.nn.dropout` offer seed parameters. These efforts are of course futile while running on a GPU, since the high degree of multithreaded calculations will result in non-deterministic behaviour.

### 1.5 5

### 1.6 6

Choosing a sensible learning rate is imperative. While a very small learning rate might take a long time to converge, a high learning rate might not reach the maximum accuracy at all. As seen in figure 2, choosing a rate of 0.001 is preferable to both 0.01 and 0.0001.

### 1.7 7

A CNN basically trains a feature extractor which is then used to classify any given data, preferably of the same type as the training data, in our case images. Figure 3 shows a visualization of these features.

### 1.8 8

Figure 4 details the accuracy in respect to various parameter changes. For the batch size and the number of kernels, a higher value results in better accuracy. While this is also the case for the kernel size, the calculation is more costly. The calculation time needed for a kernel size of 5 doubles the kernel size of 3. For the pooling, the best results are achieved with a value of 4. This seems to be the

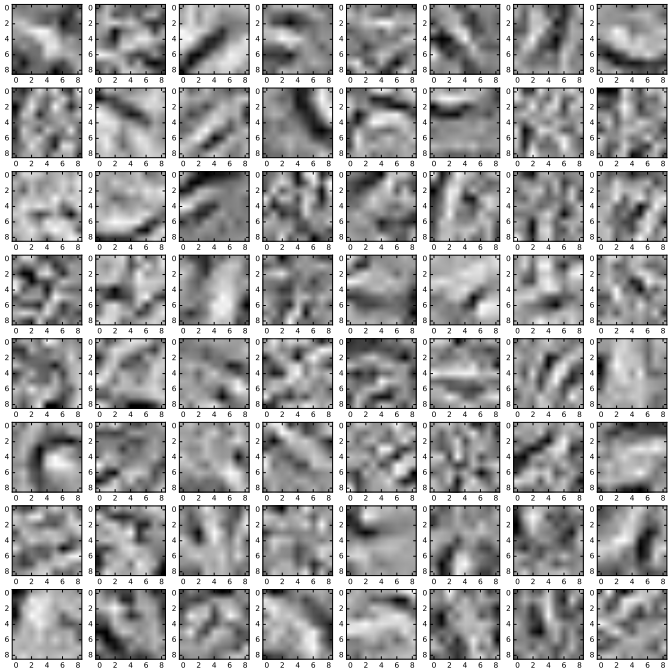

Figure 3: visualization of CNN learning

Table 1: Configurations

| Parameter | Accuracy 97.4% | Accuracy 99% |
|---|---|---|
| num_hidden | 64 | 512 |
| num_kernels1 | 4 | 16 |
| learning_rate | 0.001 | 0.001 |
| regularization_factor | 0.0001 | 0.0001 |
| batch_size | 2048 | 512 |
| dropout_keep_probability | 0.25 | 0.25 |
| seed | 666 | 666 |
| kernel1_size | 3 | 5 |
| test_interval | 100 | 100 |
| num_batches | 20001 | 2001 |
| pool | 4 | 4 |

maximum, though, since additional tests have shown that an even higher value of 7 or even 14 have a much lower rated result. The dropout keep probability shows the best results for a value of 0.25.

### 1.9 9

Table 1 shows two acceptable but small configurations.

## 2 Code and Architecture

The code is provided as Github repository and available under

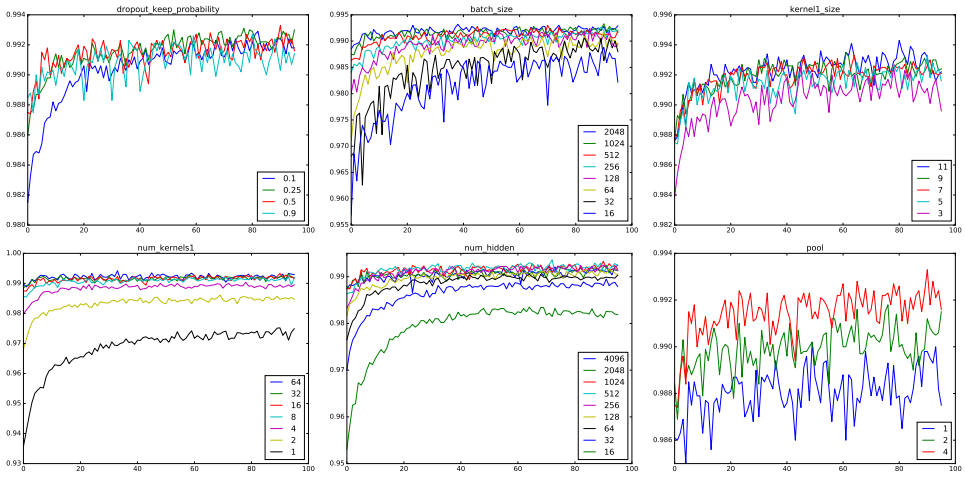


Figure 4: parameter comparison

`https://github.com/99991/DeepLearningProjects/tree/master/projects`

### 2.1 Code

### 2.2 Architecture

## 3 Training and Test

The text must be confined within a rectangle 5.5 inches (33 picas) wide and 9 inches (54 picas) long. The left margin is 1.5 inch (9 picas). Use 10 point type with a vertical spacing (leading) of 11 points. Times New Roman is the preferred typeface throughout, and will be selected for you by default. Paragraphs are separated by ½ line space (5.5 points), with no indentation.

The paper title should be 17 point, initial caps/lower case, bold, centered between two horizontal rules. The top rule should be 4 points thick and the bottom rule should be 1 point thick. Allow ¼ inch space above and below the title to rules. All pages should start at 1 inch (6 picas) from the top of the page.

For the final version, authors' names are set in boldface, and each name is centered above the corresponding address. The lead author's name is to be listed first (left-most), and the co-authors' names (if different address) are set to follow. If there is only one co-author, list both author and co-author side by side.

Please pay special attention to the instructions in Section 5 regarding figures, tables, acknowledgments, and references.

## 4 Headings: first level

All headings should be lower case (except for first word and proper nouns), flush left, and bold.

First-level headings should be in 12-point type.

### 4.1 Headings: second level

Second-level headings should be in 10-point type.

#### 4.1.1 Headings: third level

Third-level headings should be in 10-point type.

**Paragraphs** There is also a `\paragraph` command available, which sets the heading in bold, flush left, and inline with the text, with the heading followed by 1 em of space.

# 5 Citations, figures, tables, references

These instructions apply to everyone.

## 5.1 Citations within the text

The `natbib` package will be loaded for you by default. Citations may be author/year or numeric, as long as you maintain internal consistency. As to the format of the references themselves, any style is acceptable as long as it is used consistently.

The documentation for `natbib` may be found at

`http://mirrors.ctan.org/macros/latex/contrib/natbib/natnotes.pdf`

Of note is the command `\citet`, which produces citations appropriate for use in inline text. For example,

```
\citet{hasselmo} investigated\dots
```

produces

Hasselmo, et al. (1995) investigated…

If you wish to load the `natbib` package with options, you may add the following before loading the `nips_2016` package:

```
\PassOptionsToPackage{options}{natbib}
```

If `natbib` clashes with another package you load, you can add the optional argument `nonatbib` when loading the style file:

```
\usepackage[nonatbib]{nips_2016}
```

As submission is double blind, refer to your own published work in the third person. That is, use "In the previous work of Jones et al. [4]," not "In our previous work [4]." If you cite your other papers that are not widely available (e.g., a journal paper under review), use anonymous author names in the citation, e.g., an author of the form "A. Anonymous."

## 5.2 Footnotes

Footnotes should be used sparingly. If you do require a footnote, indicate footnotes with a number[1] in the text. Place the footnotes at the bottom of the page on which they appear. Precede the footnote with a horizontal rule of 2 inches (12 picas).

Note that footnotes are properly typeset *after* punctuation marks.[2]

## 5.3 Figures

All artwork must be neat, clean, and legible. Lines should be dark enough for purposes of reproduction. The figure number and caption always appear after the figure. Place one line space before the figure caption and one line space after the figure. The figure caption should be lower case (except for first word and proper nouns); figures are numbered consecutively.

You may use color figures. However, it is best for the figure captions and the paper body to be legible if the paper is printed in either black/white or in color.

[1] Sample of the first footnote.

[2] As in this example.

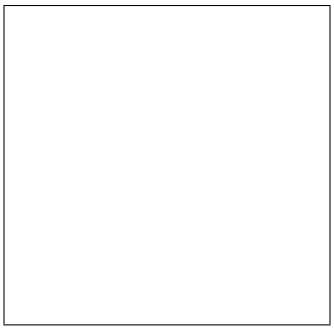

Figure 5: Sample figure caption.

Table 2: Sample table title

| | Part | |
|---|---|---|
| Name | Description | Size ($\mu$m) |
| Dendrite | Input terminal | $\sim$100 |
| Axon | Output terminal | $\sim$10 |
| Soma | Cell body | up to $10^6$ |

### 5.4 Tables

All tables must be centered, neat, clean and legible. The table number and title always appear before the table. See Table 2.

Place one line space before the table title, one line space after the table title, and one line space after the table. The table title must be lower case (except for first word and proper nouns); tables are numbered consecutively.

Note that publication-quality tables *do not contain vertical rules.* We strongly suggest the use of the `booktabs` package, which allows for typesetting high-quality, professional tables:

`https://www.ctan.org/pkg/booktabs`

This package was used to typeset Table 2.

## 6 Final instructions

Do not change any aspects of the formatting parameters in the style files. In particular, do not modify the width or length of the rectangle the text should fit into, and do not change font sizes (except perhaps in the **References** section; see below). Please note that pages should be numbered.

## 7 Preparing PDF files

Please prepare submission files with paper size "US Letter," and not, for example, "A4."

Fonts were the main cause of problems in the past years. Your PDF file must only contain Type 1 or Embedded TrueType fonts. Here are a few instructions to achieve this.

- You should directly generate PDF files using `pdflatex`.
- You can check which fonts a PDF files uses. In Acrobat Reader, select the menu Files>Document Properties>Fonts and select Show All Fonts. You can also use the program `pdffonts` which comes with `xpdf` and is available out-of-the-box on most Linux machines.
- The IEEE has recommendations for generating PDF files whose fonts are also acceptable for NIPS. Please see `http://www.emfield.org/icuwb2010/downloads/IEEE-PDF-SpecV32.pdf`

- `xfig` "patterned" shapes are implemented with bitmap fonts. Use "solid" shapes instead.
- The `\bbold` package almost always uses bitmap fonts. You should use the equivalent AMS Fonts:

  ```
  \usepackage{amsfonts}
  ```

  followed by, e.g., `\mathbb{R}`, `\mathbb{N}`, or `\mathbb{C}` for $\mathbb{R}$, $\mathbb{N}$ or $\mathbb{C}$. You can also use the following workaround for reals, natural and complex:

  ```
  \newcommand{\RR}{I\!\!R} %real numbers
  \newcommand{\Nat}{I\!\!N} %natural numbers
  \newcommand{\CC}{I\!\!\!\!C} %complex numbers
  ```

  Note that `amsfonts` is automatically loaded by the `amssymb` package.

If your file contains type 3 fonts or non embedded TrueType fonts, we will ask you to fix it.

### 7.1 Margins in LaTeX

Most of the margin problems come from figures positioned by hand using `\special` or other commands. We suggest using the command `\includegraphics` from the `graphicx` package. Always specify the figure width as a multiple of the line width as in the example below:

```
\usepackage[pdftex]{graphicx} ...
\includegraphics[width=0.8\linewidth]{myfile.pdf}
```

See Section 4.4 in the graphics bundle documentation (`http://mirrors.ctan.org/macros/latex/required/graphics/grfguide.pdf`)

A number of width problems arise when LaTeX cannot properly hyphenate a line. Please give LaTeX hyphenation hints using the `\-` command when necessary.


#### Acknowledgments

Use unnumbered third level headings for the acknowledgments. All acknowledgments go at the end of the paper. Do not include acknowledgments in the anonymized submission, only in the final paper.


## References

References follow the acknowledgments. Use unnumbered first-level heading for the references. Any choice of citation style is acceptable as long as you are consistent. It is permissible to reduce the font size to `small` (9 point) when listing the references. **Remember that you can use a ninth page as long as it contains *only* cited references.**


[1] Alexander, J.A. & Mozer, M.C. (1995) Template-based algorithms for connectionist rule extraction. In G. Tesauro, D.S. Touretzky and T.K. Leen (eds.), *Advances in Neural Information Processing Systems 7*, pp. 609–616. Cambridge, MA: MIT Press.

[2] Bower, J.M. & Beeman, D. (1995) *The Book of GENESIS: Exploring Realistic Neural Models with the GEneral NEural SImulation System.* New York: TELOS/Springer–Verlag.

[3] Hasselmo, M.E., Schnell, E. & Barkai, E. (1995) Dynamics of learning and recall at excitatory recurrent synapses and cholinergic modulation in rat hippocampal region CA3. *Journal of Neuroscience* **15**(7):5249-5262.