

Information Technology and Quantitative Management (ITQM 2016)

Hybrid learning net: a novel architecture for fast learning

Ying Liu^a, Chao Xiang^a

^aUniversity of Chinese Academy of Sciences, Beijing 47001, China

Abstract

Currently, neural networks have succeeded in object recognition tasks based on images, natural language translation, and voice recognition, to name a few. However, neural nets are customly built for different applications and vary a lot in achitectures and model hyperparameters like learning rate and parameter initialization method. To make it worse, these hyperparameter settings generally play a big role in performances of training and testing, and the best settings for specific applications are so far only available by manually trying different configurations which is really huge work.

We, thereby, present a novel neural network achitecture with Self Organizing Maps(SOMs) aided, to achieve a much faster net learning for general applications with good robustness to a few key hyperparameters. We've also experimented our architecture over the MNIST dataset, it has proved the surprising improvement on both training and testing phases of general applications, and we have unexpectedly discovered some interesting facts about neural network trainings, such as neuron activation sparsity is somehow strongly related to the training loss within certain cases.

© 2016 The Authors. Published by Elsevier B.V.

Selection and/or peer-review under responsibility of ITQM2016.

Keywords: hybrid learning;neural network;general application;sparsity;SOM;MNIST;fast;

1. Main Text

Here introduce the paper, and put a nomenclature if necessary, in a box with the same font size as the rest of the paper. The paragraphs continue from here and are only separated by headings, subheadings, images and formulae. The section headings are arranged by numbers, bold and 10 pt. Here follows further instructions for authors.

Nomenclature

- A radius of
- B position of
- C further nomenclature continues down the page inside the text box

*Corresponding author. Tel.: +0-000-000-0000 ; fax: +0-000-000-0000 .

E-mail address: author@institute.xxx.

1.1. Structure

For this Procedia the files must be in MS Word format only and should be formatted for direct printing. Figures and tables should be embedded and not supplied separately. Please make sure that you use as much as possible normal fonts in your documents.

Special fonts, such as fonts used in the Far East (Japanese, Chinese, Korean, etc.) may cause problems during processing.

To avoid unnecessary errors you are strongly advised to use the ‘spellchecker’ function of MS Word. Follow this order when typing manuscripts: Title, Authors, Affiliations, Abstract, Keywords, Main text (including figures and tables), Acknowledgements, References, and Appendix. Collate acknowledgements in a separate section at the end of the article and do not include them on the title page, as a footnote to the title or otherwise.

For this Procedia the files must be in MS Word format only and should be formatted for direct printing. Figures and tables should be embedded and not supplied separately. Please make sure that you use as much as possible normal fonts in your documents. Special fonts, such as fonts used in the Far East (Japanese, Chinese, Korean, etc.) may cause problems during processing.

To avoid unnecessary errors you are strongly advised to use the ‘spellchecker’ function of MS Word. Follow this order when typing manuscripts: Title, Authors, Affiliations, Abstract, Keywords, Main text (including figures and tables), Acknowledgements,

References, Appendix. Collate acknowledgements in a separate section at the end of the article and do not include them on the title page, as a footnote to the title or otherwise.

Bulleted lists may be included and should look like this:

- First point
- Second point
- And so on

Ensure that you return to the ‘Els-body-text’ style, the style that you will mainly be using for large blocks of text, when you have completed your bulleted list.

Please do not alter the formatting and style layouts which have been set up in this template document. As indicated in the template, Papers should be prepared in single column format suitable for direct printing onto paper size (192 x 262) mm. Do not number pages on the front, as page numbers will be added separately for the preprints and the Proceedings. Leave a line clear between paragraphs. All the required style templates are provided in this document with the appropriate name supplied e.g. choose 1. Els1st-order-head for your first order heading text, els-abstract-text for the abstract text etc.

1.2. Tables

All tables should be numbered with Arabic numerals. Headings should be placed above tables, left justified. Leave one line space between the heading and the table. Only horizontal lines should be used within a table, to distinguish the column headings from the body of the table, and immediately above and below the table. Tables must be embedded into the text and not supplied separately. Below is an example which authors may find useful.

Table 1. An example of a table.

An example of a column heading	Column A (t)	Column B (T)
And an entry	1	2
And another entry	3	4
And another entry	5	6

1.3. Construction of references

References should be added at the end of the paper, and its corresponding citation will be added in the order of their appearance in the text. Authors should ensure that every reference in the text appears in the list of references and vice versa. Indicate references by [1], [2-3] in the text. The actual authors can be referred to, but the reference citation(s) must always be given. Some examples of how your references should be listed are given at the end of this template in the ‘References’ section, which will allow you to assemble your reference list according to the correct format and font size.

1.4. Section headings

Section headings should be left justified, with the first letter capitalized and numbered consecutively, starting with the Introduction. Sub-section headings should be in capital and lower-case italic letters, numbered 1.1, 1.2, etc, and left justified, with second and subsequent lines indented. You may need to insert a page break to keep a heading with its text.

1.5. General guidelines for the preparation of your text

Avoid hyphenation at the end of a line. Symbols denoting vectors and matrices should be indicated in bold type. Scalar variable names should normally be expressed using italics. Weights and measures should be expressed in SI units. Please title your files in this order conferenceacronym_authorslastname.pdf

2. Author Artwork

All figures should be numbered with Arabic numerals (1,2,...n). All photographs, schemas, graphs and diagrams are to be referred to as figures. Line drawings should be good quality scans or true electronic output. Low-quality scans are not acceptable. Figures must be embedded into the text and not supplied separately. Lettering and symbols should be clearly defined either in the label or in a legend provided as part of the figure. Figures should be placed at the top or bottom of a page wherever possible, as close as possible to the first reference to them in the paper.

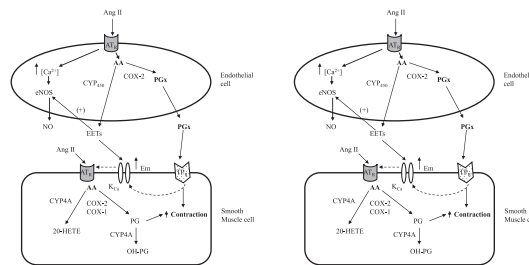


Fig. 1. (a) first picture; (b) second picture.

The figure number and caption should be typed below the illustration in 8 pt and left justified. For more guidelines and information to help you submit high quality artwork please visit: <http://www.elsevier.com/locate/authorview>. Artwork has no text along the side of it in the main body of the text. However, if two images fit next to each other, these may be placed next to each other to save space, see Fig 1. They must be numbered consecutively, all figures, and all tables respectively.

2.1. Footnotes

Footnotes should be avoided if possible. Necessary footnotes should be denoted in the text by consecutive superscript letters. The footnotes should be typed single spaced, and in smaller type size (8 pt), at the foot of the page in which they are mentioned, and separated from the main text by a short line extending at the foot of the column. The ‘Els-footnote’ style is available in this template for the text of the footnote.

Equations and formulae should be typed and numbered consecutively with Arabic numerals in parentheses on the right hand side of the page (if referred to explicitly in the text),

$$X_r = \dot{Q}_{rad} / (\dot{Q}_{rad} + \dot{Q}_{conv})$$

$$\rho = \frac{\vec{E}}{J_c(T = \text{const.}) \cdot \left(P \cdot \left(\frac{\vec{E}}{E_c} \right)^m + (1 - P) \right)} \quad (1)$$

They should also be separated from the surrounding text by one space.

3. Online licence

All authors must Transfer the Online licence before the article can be published. This transfer agreement enables Elsevier to protect the copyrighted material for the authors, but does not relinquish the authors' proprietary rights. The copyright transfer covers the exclusive rights to reproduce and distribute the article, including reprints, photographic reproductions, microfilm or any other reproductions of similar nature and translations. Authors are responsible for obtaining from the copyright holder permission to reproduce any figures for which copyright exists.

The citation must be used in following style: [?], [?], [?], [?] and [?].

Acknowledgements

These and the Reference headings are in bold but have no numbers. Text below continues as normal.

Appendix A. An example appendix

Authors including an appendix section should do so after References section. Multiple appendices should all have headings in the style used above. They will automatically be ordered A, B, C etc.

Appendix A.1. Example of a sub-heading within an appendix

There is also the option to include a subheading within the Appendix if you wish.