[[1]](#footnote-1)

COM 599100 Deep Learning Final Project Proposal – Protein Family (Group 4)

First A. Author (team leader), Second B. Author, and so on

*Abstract*—Begin with specifying the task region (FinTech, Bio or CV) and task number, the abstract must be a concise yet comprehensive reflection of your task content. In particular, the abstract must be self-contained, without abbreviations, footnotes, or references. It should be a microcosm of the full proposal. The abstract must be between 150–250 words. It must be written as one paragraph, and should not contain displayed mathematical equations or tabular material. Please do your best to ensure that the abstract reads well and is grammatically correct. Also, if you want to propose extended topics on the top of given tasks, remember to emphasize them in this section.

*Index Terms*—Enter key words or phrases in alphabetical order, separated by commas.

# INTRODUCTION

W

ith the development of advanced measuring techniques and instruments, we are able to retrieve a myriad of important information about the structure of biological macromolecules using X-ray crystallography, Nuclear Magnetic Resonance (NMR) spectroscopy and cryo-electron microscopy. Accurate identification of protein functions has applications in a wide variety of areas, such as understanding diseases, drug design and genetic engineering for agriculture. Nevertheless, high throughput experiments like the next generation sequencing technologies are resulting in a large number of new protein sequences uncharacterized.

Sequenced-based methods for protein fold recognition can be summarized into two categories: the sequence alignment methods and machine learning/deep learning based methods. The former one determines the unknown structure of sequences by calculating the alignment scores between sequences. Despite the success, the sequence alignment methods are essentially an indirect means of nearest neighbor methods, which cannot give an insightful explanation about the sequence-structure relationship. Consequently, we are motivated to propose a deep learning-based end-to-end protein structure classifier. We can expect our model not only have a decent performance in terms of classification accuracy but also obtain meaningful features extracted automatically from the neural networks without the bioinformatics expertise.

# Material and Method

State the characteristic of your dataset, along with your proposed method and the workflow. You can use sub-section title as follows:

## Example of sub-section title A

## Example of sub-section title B

For typing equations*,* you should use the Microsoft Equation Editor. “Float over text” should *not* be selected. Number equations consecutively with equation numbers in parentheses flush with the right margin, as in (1).

Equation example (1)

Be sure that the symbols in your equation have been defined before the equation appears or immediately following.While you want to describe something using previous equations, please refer to “(1),” not “Eq. (1)” or “equation (1),” except at the beginning of a sentence: “Equation (1) is ... .”

Charts, graphs, and tables are one column wide (3.5 inches / 88 millimeters / 21 picas) or page wide (7.16 inches / 181 millimeters / 43 picas). The following are some examples:



Fig. 1. Magnetization as a function of applied field. Note that “Fig.” is abbreviated. There is a period after the figure number, followed by two spaces. It is good practice to explain the significance of the figure in the caption.

TABLE I

Units for Magnetic Properties

|  |  |  |
| --- | --- | --- |
| Symbol | Quantity | Conversion from Gaussian and  CGS EMU to SI a |
| Φ | magnetic flux | 1 Mx → 10−8 Wb = 10−8 V·s |
| *B* | magnetic flux density,  magnetic induction | 1 G → 10−4 T = 10−4 Wb/m2 |
| *H* | magnetic field strength | 1 Oe → 103/(4π) A/m |
| *m* | magnetic moment | 1 erg/G = 1 emu  → 10−3 A·m2 = 10−3 J/T |
| *M* | magnetization | 1 erg/(G·cm3) = 1 emu/cm3  → 103 A/m |
| 4π*M* | magnetization | 1 G → 103/(4π) A/m |
| σ | specific magnetization | 1 erg/(G·g) = 1 emu/g → 1 A·m2/kg |
| *j* | magnetic dipole  moment | 1 erg/G = 1 emu  → 4π × 10−10 Wb·m |
| *J* | magnetic polarization | 1 erg/(G·cm3) = 1 emu/cm3  → 4π × 10−4 T |
| χ*,* κ | susceptibility | 1 → 4π |
| χρ | mass susceptibility | 1 cm3/g → 4π × 10−3 m3/kg |
| μ | permeability | 1 → 4π × 10−7 H/m  = 4π × 10−7 Wb/(A·m) |
| μr | relative permeability | μ → μr |
| *w, W* | energy density | 1 erg/cm3 → 10−1 J/m3 |
| *N, D* | demagnetizing factor | 1 → 1/(4π) |

Vertical lines are optional in tables. Statements that serve as captions for the entire table do not need footnote letters.

aGaussian units are the same as cg emu for magnetostatics; Mx = maxwell, G = gauss, Oe = oersted; Wb = weber, V = volt, s = second, T = tesla, m = meter, A = ampere, J = joule, kg = kilogram, H = henry.

# Evaluation

In this section, you have to state and explain the expected results of your task, and how to evaluate the performance. For example, the groups working on classification and regression tasks should specify the test metrics they plan to report (e.g. precision, recall, F-score, AUROC, AUPRC, etc.).

For evaluation of our model, we calculate several performance measures, such as: precision, recall, accuracy, and F1 score defined as:

Where tp are the number of true positives, fp are the number of false positives, tn are the number of true negatives and fn are the number of false negatives

# Discussion

In this section, you can discuss about the potential difficulties in your task, plan B for your proposed method, etc.

# References

*Basic format for journals (when available online):*

J. K. Author, “Name of paper,” *Abbrev. Title of Periodical*, vol. *x*, no. *x*, pp. *xxx-xxx*, Abbrev. Month, year. Accessed on: Month, Day, year, DOI: 10.1109.*XXX*.123456, [Online].

*Examples:*

1. J. S. Turner, “New directions in communications,” *IEEE J. Sel. Areas Commun*., vol. 13, no. 1, pp. 11-23, Jan. 1995.
2. W. P. Risk, G. S. Kino, and H. J. Shaw, “Fiber-optic frequency shifter using a surface acoustic wave incident at an oblique angle,” *Opt. Lett.*, vol. 11, no. 2, pp. 115–117, Feb. 1986.
3. P. Kopyt *et al., “*Electric properties of graphene-based conductive layers from DC up to terahertz range,” *IEEE THz Sci. Technol.,* to be published. DOI: 10.1109/TTHZ.2016.2544142.

*Basic format for papers presented at conferences (when available online):*

J.K. Author. (year, month). Title. presented at abbrev. conference title. [Type of Medium]. Available: site/path/file

*Example:*

1. PROCESS Corporation, Boston, MA, USA. Intranets: Internet technologies deployed behind the firewall for corporate productivity. Presented at INET96 Annual Meeting. [Online]. Available: http://home.process.com/Intranets/wp2.htp
2. http://www.lytera.de/Terahertz\_THz\_Spectroscopy.php?id=home, Accessed on: Jun. 5, 2014

*Basic format**for theses (M.S.) and dissertations (Ph.D.):*

a) J. K. Author, “Title of thesis,” M.S. thesis, Abbrev. Dept., Abbrev. Univ., City of Univ., Abbrev. State, year.

b) J. K. Author, “Title of dissertation,” Ph.D. dissertation, Abbrev. Dept., Abbrev. Univ., City of Univ., Abbrev. State, year.

*Examples:*

1. J. O. Williams, “Narrow-band analyzer,” Ph.D. dissertation, Dept. Elect. Eng., Harvard Univ., Cambridge, MA, USA, 1993.
2. N. Kawasaki, “Parametric study of thermal and chemical nonequilibrium nozzle flow,” M.S. thesis, Dept. Electron. Eng., Osaka Univ., Osaka, Japan, 1993.

*Example when using et al.:*

1. S. Azodolmolky *et al.*, Experimental demonstration of an impairment aware network planning and operation tool for transparent/translucent optical networks,” *J. Lightw. Technol.*, vol. 29, no. 4, pp. 439–448, Sep. 2011.

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