A replication study of transformer-based TabPFN for assessing the applicability of neural-network based solutions in tabular classification.

Kartikey Chauhan[1]

[1]Data Science & Analytics, Toronto Metropolitan University

Abstract

Abstracts must be able to stand alone and so cannot contain citations to the paper's references, equations, etc. An abstract must consist of a single paragraph and be concise. Because of online formatting, abstracts must appear as plain as possible. Three to six keywords must be included. Each keyword should not exceed three words.

Keywords: keyword1, keyword2, keyword3, keyword4, keyword5, keyword6.

1. Introduction

Your introduction goes here! Simply start writing your document and use the Recompile button to view the updated PDF preview. Examples of commonly used commands and features are listed below to help you get started. Nam dui ligula, fringilla a, euismod sodales, sollicitudin vel, wisi. Morbi auctor lorem non justo. Nam lacus libero, pretium at, lobortis vitae, ultricies et, tellus. Donec aliquet, tortor sed accumsan bibendum, erat ligula aliquet magna, vitae ornare odio metus a mi. Morbi ac orci et nisl hendrerit mollis. Suspendisse ut massa. Cras nec ante. Pellentesque a nulla. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Aliquam tincidunt urna. Nulla ullamcorper vestibulum turpis. Pellentesque cursus luctus mauris.

Once familiar with the editor, you can find various project settings in the Overleaf menu, accessed via the button at the top left of the editor. To view tutorials, user guides, and further documentation, please visit our help library, or head to our plans page to choose your plan.

This is an example of a new paragraph with a numbered footnote[1] and a second footnote marker.[2]

2. Example for First Level Head - Section Head

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

Quisque ullamcorper placerat ipsum. Cras nibh. Morbi vel justo vitae lacus tincidunt ultrices. Lorem ipsum dolor sit amet, consectetuer adipiscing elit. In hac habitasse platea dictumst. Integer tempus convallis augue. Etiam facilisis. Nunc elementum fermentum wisi. Aenean placerat. Ut imperdiet, enim

---

[1]https://data.gov.uk/
[2]Example of footnote text.

sed gravida sollicitudin, felis odio placerat quam, ac pulvinar elit purus eget enim. Nunc vitae tortor. Proin tempus nibh sit amet nisl. Vivamus quis tortor vitae risus porta vehicula.

2.1   How to create sections and subsections

Simply use the section and subsection commands, as in this example document! With Overleaf, all the formatting and numbering is handled automatically according to the template you've chosen. If you're using the Visual Editor, you can also create new sections and subsections via the buttons in the editor toolbar.

2.2   This is an example for second level head - subsection head

Fusce mauris. Vestibulum luctus nibh at lectus. Sed bibendum, nulla a faucibus semper, leo velit ultricies tellus, ac venenatis arcu wisi vel nisl. Vestibulum diam. Aliquam pellentesque, augue quis sagittis posuere, turpis lacus congue quam, in hendrerit risus eros eget felis. Maecenas eget erat in sapien mattis porttitor. Vestibulum porttitor. Nulla facilisi. Sed a turpis eu lacus commodo facilisis. Morbi fringilla, wisi in dignissim interdum, justo lectus sagittis dui, et vehicula libero dui cursus dui. Mauris tempor ligula sed lacus. Duis cursus enim ut augue. Cras ac magna. Cras nulla. Nulla egestas. Curabitur a leo. Quisque egestas wisi eget nunc. Nam feugiat lacus vel est. Curabitur consectetuer.

2.2.1   This is an example for third level head - subsubsection head

Suspendisse vel felis. Ut lorem lorem, interdum eu, tincidunt sit amet, laoreet vitae, arcu. Aenean faucibus pede eu ante. Praesent enim elit, rutrum at, molestie non, nonummy vel, nisl. Ut lectus eros, malesuada sit amet, fermentum eu, sodales cursus, magna. Donec eu purus. Quisque vehicula, urna sed ultricies auctor, pede lorem egestas dui, et convallis elit erat sed nulla. Donec luctus. Curabitur et nunc. Aliquam dolor odio, commodo pretium, ultricies non, pharetra in, velit. Integer arcu est, nonummy in, fermentum faucibus, egestas vel, odio.

This is an example for fourth level head - paragraph head
Sed commodo posuere pede. Mauris ut est. Ut quis purus. Sed ac odio. Sed vehicula hendrerit sem. Duis non odio. Morbi ut dui. Sed accumsan risus eget odio. In hac habitasse platea dictumst. Pellentesque non elit. Fusce sed justo eu urna porta tincidunt. Mauris felis odio, sollicitudin sed, volutpat a, ornare ac, erat. Morbi quis dolor. Donec pellentesque, erat ac sagittis semper, nunc dui lobortis purus, quis congue purus metus ultricies tellus. Proin et quam. Class aptent taciti sociosqu ad litora torquent per conubia nostra, per inceptos hymenaeos. Praesent sapien turpis, fermentum vel, eleifend faucibus, vehicula eu, lacus.

3.   Example for First Level Head

3.1   This is an example for second level head - subsection head

3.1.1   This is an example for third level head - subsubsection head

Pellentesque habitant morbi tristique senectus et netus et malesuada fames ac turpis egestas. Donec odio elit, dictum in, hendrerit sit amet, egestas sed, leo. Praesent feugiat sapien aliquet odio. Integer vitae justo. Aliquam vestibulum fringilla lorem. Sed neque lectus, consectetuer at, consectetuer sed, eleifend ac, lectus. Nulla facilisi. Pellentesque eget lectus. Proin eu metus. Sed porttitor. In hac habitasse platea dictumst. Suspendisse eu lectus. Ut mi mi, lacinia sit amet, placerat et, mollis vitae, dui. Sed ante tellus, tristique ut, iaculis eu, malesuada ac, dui. Mauris nibh leo, facilisis non, adipiscing quis, ultrices a, dui.

This is an example for fourth level head - paragraph head

Morbi luctus, wisi viverra faucibus pretium, nibh est placerat odio, nec commodo wisi enim eget quam. Quisque libero justo, consectetuer a, feugiat vitae, porttitor eu, libero. Suspendisse sed mauris vitae elit sollicitudin malesuada. Maecenas ultricies eros sit amet ante. Ut venenatis velit. Maecenas sed mi eget dui varius euismod. Phasellus aliquet volutpat odio. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Pellentesque sit amet pede ac sem eleifend consectetuer. Nullam elementum, urna vel imperdiet sodales, elit ipsum pharetra ligula, ac pretium ante justo a nulla. Curabitur tristique arcu eu metus. Vestibulum lectus. Proin mauris. Proin eu nunc eu urna hendrerit faucibus. Aliquam auctor, pede consequat laoreet varius, eros tellus scelerisque quam, pellentesque hendrerit ipsum dolor sed augue. Nulla nec lacus.

4. How to Include Equations

Equations in LaTeX can either be inline or set as display equations. For inline equations use the `$...$` commands. Eg: the equation $H\psi = E\psi$ is written via the command `$H \psi = E \psi$`.

For display equations (with auto generated equation numbers) one can use the equation or eqnarray environments:

$$\|\tilde{X}(k)\|^2 \leq \frac{\sum_{i=1}^{p} \left\|\tilde{Y}_i(k)\right\|^2 + \sum_{j=1}^{q} \left\|\tilde{Z}_j(k)\right\|^2}{p+q}, \tag{1}$$

where

$$D_\mu = \partial_\mu - ig\frac{\lambda^a}{2}A_\mu^a$$
$$F_{\mu\nu}^a = \partial_\mu A_\nu^a - \partial_\nu A_\mu^a + gf^{abc}A_\mu^b A_\nu^a \tag{2}$$

Notice the use of `\nonumber` in the align environment at the end of each line, except the last, so as not to produce equation numbers on lines where no equation numbers are required. The `\label{}` command should only be used at the last line of an align environment where `\nonumber` is not used.

$$Y_\infty = \left(\frac{m}{\text{GeV}}\right)^{-3} \left[1 + \frac{3\ln(m/\text{GeV})}{15} + \frac{\ln(c_2/5)}{15}\right] \tag{3}$$

The class file also supports the use of `\mathbb{}`, `\mathscr{}` and `\mathcal{}` commands. As such `\mathbb{R}`, `\mathscr{R}` and `\mathcal{R}` produces $\mathbb{R}$, $\mathscr{R}$ and $\mathcal{R}$ respectively

Equations must be provided as editable text, either in a Word or LaTeX source file. They should be numbered consecutively through the manuscript as shown in Equations 1, 2 and 3. In APA style, when discussing numbered equations in the text, write out the word "Equation" and give the number. For example, you would write "see Equation 1." Use no punctuation after the equation if it appears at the end of a sentence; however, it is permissible (and may even be necessary) to place some form of punctuation after it (a comma or semi-colon, for example) if it appears in the middle of the sentence and is followed by text. In any case, maintain the coherence of all sentences with equations in them.

5. How to Include Tables

Use the table and tabular environments for basic tables — see Tables 1 and 2, for example. Table 1 is an sample figure including table footnotes. For more information, please see this help article on tables.

Table 1: Sample table with footnotes

column 1	column 2	column 3	column 4
row 1	data 1	data 2	data 3
row 2	data 4	data 5[1]	data 6
row 3	data 7	data 8	data 9[2]

Source: This is an example of table footnote. This is an example of table footnote. This is an example of table footnote. This is an example of table footnote. This is an example of table footnote.

[1] Example for a first table footnote.

[2] Example for a second table footnote.

Table 2: Example of a lengthy table which is set to full textwidth.

Project	Element 1[1]			Element 2[2]		
	Energy	σ_{calc}	σ_{expt}	Energy	σ_{calc}	σ_{expt}
Element 3	990 A	1168	1547 ± 12	780 A	1166	1239 ± 100
Element 4	500 A	961	922 ± 10	900 A	1268	1092 ± 40

Note: This is an example of table footnote this is an example of table footnote this is an example of table footnote this is an example of table footnote this is an example of table footnote.

[1] Example for a first table footnote.

[2] Example for a second table footnote.

6. How to Include Figures

First you have to upload the image file from your computer using the upload link in the file-tree menu. Then use the includegraphics command to include it in your document. Use the figure environment and the caption command to add a number and a caption to your figure. See the code for Figure 1 in this section for an example. As shown in Figures 1 and 2, the images should be single-page documents.

Note that your figure will automatically be placed in the most appropriate place for it, given the surrounding text and taking into account other figures or tables that may be close by. You can find out more about adding images to your documents in this help article on including images on Overleaf.
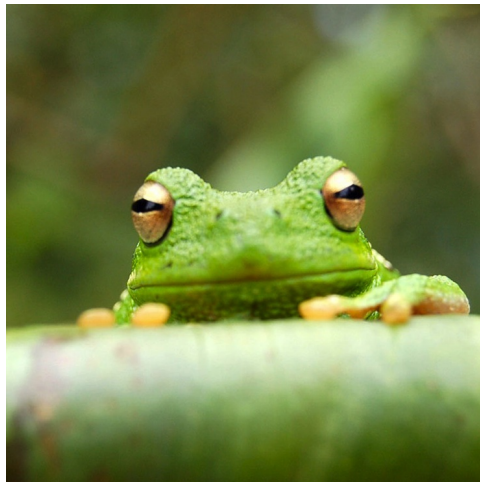

Figure 1: This frog was uploaded via the file-tree menu.

6.1 More information about figures

As per display LaTeX standards one has to use eps images for `latex` compilation and `pdf/jpg/png` images for `pdflatex` compilation. This is one of the major differences between `latex` and `pdflatex`. The images

should be single-page documents. The command for inserting images for `latex` and `pdflatex` can be generalized. The package used to insert images in `latex/pdflatex` is the graphicx package. Figures can be inserted via the normal figure environment as shown in the below example:
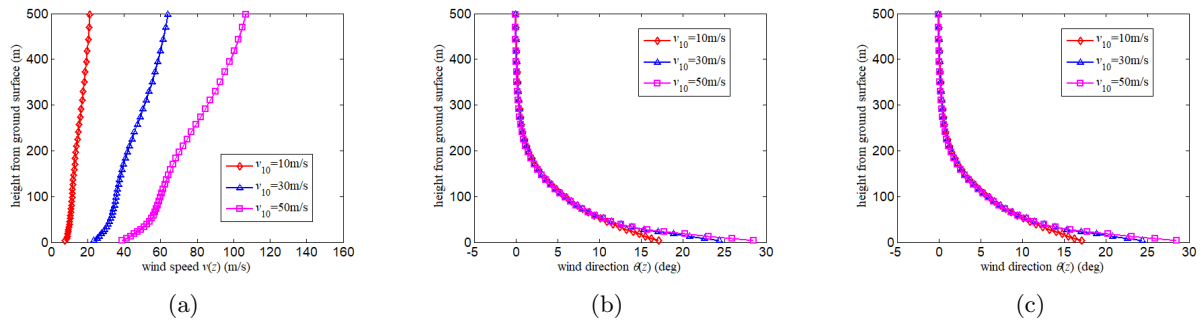

Figure 2: Overall caption for the three figures: (a) caption for figure a, (b) caption for figure b, and (c) caption for figure c.

```
\begin{figure}[h]
        \centering\includegraphics{<eps-file>}
        \caption{<figure-caption>}
        \label{<figure-label>}
\end{figure}
```

7. How to Include Algorithms, Program Codes, and Listings

Packages `algorithm`, `algorithmicx`, and `algpseudocode` are used for setting algorithms in latex. For this, one has to use the below format:

```
\begin{algorithm}
\caption{<alg-caption>}\label{<alg-label>}
\begin{algorithmic}[1]
. . .
\end{algorithmic}
\end{algorithm}
```

You may need to refer to the above-listed package documentation for more details before setting an `algorithm` environment. To set program codes, one has to use the `program` package. We need to use the `\begin{program} ... \end{program}` environment to set program codes.

Similarly, for `listings`, one has to use the `listings` package. To set environments similar to the `verbatim` environment, the `\begin{lstlisting} ... \end{lstlisting}` environment is used . Refer to the `lstlisting` package documentation for more details on this.

```
for i:=maxint to 0 do
begin
{ do nothing }
end;
Write('Case insensitive ');
Write('Pascal keywords.');
```

Algorithm 1 Calculate $y = x^n$

Require: $n \geq 0 \vee x \neq 0$
Ensure: $y = x^n$
 1: $y \Leftarrow 1$
 2: **if** $n < 0$ **then**
 3:     $X \Leftarrow 1/x$
 4:     $N \Leftarrow -n$
 5: **else**
 6:     $X \Leftarrow x$
 7:     $N \Leftarrow n$
 8: **end if**
 9: **while** $N \neq 0$ **do**
10:     **if** N is even **then**
11:       $X \Leftarrow X \times X$
12:       $N \Leftarrow N/2$
13:     **else**[N is odd]
14:       $y \Leftarrow y \times X$
15:       $N \Leftarrow N - 1$
16:     **end if**
17: **end while**

---

8.   How to Include Lists

List in LaTeX can be of three types: numbered, bulleted, and unnumbered. The "enumerate" environment produces a numbered list, the "itemize" environment produces a bulleted list, and the "unlist" environment produces an unnumbered list. In each environment, a new entry is added via the `\item` command.

1. This is the 1st item

2. Enumerate creates numbered lists, itemize creates bulleted lists, and unnumerate creates unnumbered lists.

   a. Second level numbered list. Enumerate creates numbered lists, itemize creates bulleted lists, and description creates unnumbered lists.

   b. Second level numbered list. Enumerate creates numbered lists, itemize creates bulleted lists, and description creates unnumbered lists.

      (i) Third level numbered list. Enumerate creates numbered lists, itemize creates bulleted lists, and description creates unnumbered lists.

      (ii) Third level numbered list. Enumerate creates numbered lists.

   c. Second level numbered list. Enumerate creates numbered lists, itemize creates bulleted lists, and description creates unnumbered lists.

3. Numbered lists continue.

Lists in LaTeX can be of three types: enumerate, itemize, and description. In each environment, a new entry is added via the `\item` command.

- First level bulleted list. This is the 1st item

- First level bulleted list. Itemize creates bulleted lists, and description creates unnumbered lists.

  – Second level dashed list. Itemize creates bulleted lists, and description creates unnumbered lists.

  – Second level dashed list. Itemize creates bulleted lists, and description creates unnumbered lists.

- First level bulleted list. Bullet lists continue.

Example for unnumbered list items:

Sample unnumberd list text. Sample unnumberd list text. Sample unnumberd list text. Sample unnumberd list text. Sample unnumberd list text.

Sample unnumberd list text. Sample unnumberd list text. Sample unnumberd list text.

Sample unnumberd list text. Sample unnumberd list text. Sample unnumberd list text. Sample unnumberd list text.

9. How to Add Citations and a References List

You can simply upload a `.bib` file containing your BibTeX entries, created with a tool such as JabRef. You can then cite entries from it, like this: greenwade93. Just remember to specify a bibliography style, as well as the filename of the `.bib`. You can find a video tutorial here to learn more about BibTeX.

Here is an example citation when you want an author name like collins2011a to appear in the text. And here's how to do a parenthetic citation, when you want to mention a reference at the end of a sentence or part of a sentence collins2013. It is possible to cite multiple references at the same time collins2011b,collins2016,lunn2007a,lunn2007b,ross2006,shannon1948.

If you have an upgraded account, you can also import your Mendeley or Zotero library directly as a `.bib` file, via the upload menu in the file-tree.

9.1 Citation in text

Please ensure that every reference cited in the text is also present in the reference list (and vice versa). Citations in the text should follow the referencing style used by the American Psychological Association. You are referred to the Publication Manual of the American Psychological Association (APA), Seventh Edition, ISBN 978-1-4338-3215-4, copies of which may be ordered online. References in the Abstract should be avoided, but if essential, then cite the author(s) and year(s). Unpublished results and personal communications are not recommended in the reference list but may be mentioned in the text. If these references are included in the reference list, they should follow the standard reference style of the journal and should include a substitution of the publication date with either 'Unpublished results' or 'Personal communication'. The citation of a reference as 'in press' implies that the item has been accepted for publication.

An APA in-text citation includes only three items: the last name(s) of the author(s), the year the source was published, and sometimes the page or location of the information. More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c', etc., placed after the year of publication. The following paragraph shows examples of APA style of citations.

Here is an example citation when you want an author name like collins2011a to appear in the text. And here's how to do a parenthetic citation when you want to mention a reference at the end of a sentence or part of a sentence collins2013. It is possible to cite multiple references at the same time collins2011b,collins2016,lunn2007a,lunn2007b,ross2006,shannon1948.

The followings are examples for `\textcite{...}`: rahman2019centroidb, krizhevsky2012imagenet, horvath2018dna, and lecun2015deep, zhang2018fine, ravi2016deep. Another example for `\parencite{...}`: bahdanau2014neural,imboden2018cardiorespiratory,motiian2017unified,murphy2012machine,ji20123d.

9.2 References

The Reference Section, also called the Reference List or Cited Works List, is a list of the full-text details of the in-text citations that have been used in the main text. It includes information such as the name of

the author(s), the year the source was published, the full title of the source, and the URL or page range. The Reference Section allows the reader to find the text easily and can be considered as the long-hand format of the in-text citation. It is found at the end of the piece of writing. The works in a reference section should be arranged first alphabetically and then further sorted chronologically if necessary.

9.2.1 Web references

As a minimum, the full URL should be given and the date when the reference was last accessed. Any further information, if known (DOI, author names, dates, reference to a source publication, etc.), should also be given. Web references can be listed separately (e.g., after the reference list) under a different heading if desired or can be included in the reference list. With standard numerical .bst files, only numerical citations are possible. With an author-year .bst file, both numerical and author-year citations are possible.

9.2.2 Examples for reference style

You can find information about the examples of APA-style references to various sources at the following site:
https://apastyle.apa.org/style-grammar-guidelines/references/examples.

10. Conclusions

Some conclusions here.

Conflicts of Interest

Declare conflicts of interest or state "The authors declare no conflict of interest." Authors must identify and declare any personal circumstances or interests that may be perceived as inappropriately influencing the representation or interpretation of reported research results. A detailed definition of conflicts of interest is available at the following site: https://academic.oup.com/journals/pages/authors/preparing_your_manuscript/ethics#conflict.

Author Contributions

Must include all authors, identified by initials, for example: "Conceptualization, S.R.. and D.A.; methodology, S.R..; software, S.R..; validation, S.R.., D.A. and K.L.; formal analysis, S.R..; investigation, S.R..; resources, S.R..; data curation, S.R..; writing—original draft preparation, S.R..; writing—review and editing, S.R..; visualization, S.R..; supervision, S.R..; project administration, S.R..; funding acquisition, D.A." Individual contributions are specified according to NISO CrediT (Contributor Roles Taxonomy) described at the following site: https://credit.niso.org/.

Acknowledgments

A. Some Notation

Suspendisse vitae elit. Aliquam arcu neque, ornare in, ullamcorper quis, commodo eu, libero. Fusce sagittis erat at erat tristique mollis. Maecenas sapien libero, molestie et, lobortis in, sodales eget, dui. Morbi ultrices rutrum lorem. Nam elementum ullamcorper leo. Morbi dui. Aliquam sagittis. Nunc placerat. Pellentesque tristique sodales est. Maecenas imperdiet lacinia velit. Cras non urna. Morbi eros pede, suscipit ac, varius vel, egestas non, eros. Praesent malesuada, diam id pretium elementum, eros sem dictum tortor, vel consectetuer odio sem sed wisi.

A.1 Appendix subsection title here

As shown in Equation A1, the section number is inserted in the equation number. Sed feugiat. Cum sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Ut pellentesque augue sed urna. Vestibulum diam eros, fringilla et, consectetuer eu, nonummy id, sapien. Nullam at lectus. In sagittis ultrices mauris. Curabitur malesuada erat sit amet massa. Fusce blandit. Aliquam erat volutpat. Aliquam euismod. Aenean vel lectus. Nunc imperdiet justo nec dolor.

$$Y_\infty = \left(\frac{m}{\text{GeV}}\right)^{-3}\left[1 + \frac{3\ln(m/\text{GeV})}{15} + \frac{\ln(c_2/5)}{15}\right] \tag{A1}$$

A.2 Appendix subsection title here

As shown in Table A1, the section number is inserted in the table number. Etiam euismod. Fusce facilisis lacinia dui. Suspendisse potenti. In mi erat, cursus id, nonummy sed, ullamcorper eget, sapien. Praesent pretium, magna in eleifend egestas, pede pede pretium lorem, quis consectetuer tortor sapien facilisis magna. Mauris quis magna varius nulla scelerisque imperdiet. Aliquam non quam. Aliquam porttitor quam a lacus. Praesent vel arcu ut tortor cursus volutpat. In vitae pede quis diam bibendum placerat. Fusce elementum convallis neque. Sed dolor orci, scelerisque ac, dapibus nec, ultricies ut, mi. Duis nec dui quis leo sagittis commodo.

Table A1: Sample table with three parts and five columns

column 1	column 2	column 3	column 4	column 5
row 1	data 0	data 1	data 2	data 3
row 2	data 4	data 5	data 6	data 7
row 3	data 8	data 9	data 10	data 11

B. Some More Notation

As shown in Figure B1, the section number is inserted in the figure number. Aliquam lectus. Vivamus leo. Quisque ornare tellus ullamcorper nulla. Mauris porttitor pharetra tortor. Sed fringilla justo sed mauris. Mauris tellus. Sed non leo. Nullam elementum, magna in cursus sodales, augue est scelerisque sapien, venenatis congue nulla arcu et pede. Ut suscipit enim vel sapien. Donec congue. Maecenas urna mi, suscipit in, placerat ut, vestibulum ut, massa. Fusce ultrices nulla et nisl.

B.1 Appendix subsection title here

Etiam ac leo a risus tristique nonummy. Donec dignissim tincidunt nulla. Vestibulum rhoncus molestie odio. Sed lobortis, justo et pretium lobortis, mauris turpis condimentum augue, nec ultricies nibh arcu pretium enim. Nunc purus neque, placerat id, imperdiet sed, pellentesque nec, nisl. Vestibulum imperdiet neque non sem accumsan laoreet. In hac habitasse platea dictumst. Etiam condimentum facilisis libero.

Figure B1: This is an example of the appendix figure.

Suspendisse in elit quis nisl aliquam dapibus. Pellentesque auctor sapien. Sed egestas sapien nec lectus. Pellentesque vel dui vel neque bibendum viverra. Aliquam porttitor nisl nec pede. Proin mattis libero vel turpis. Donec rutrum mauris et libero. Proin euismod porta felis. Nam lobortis, metus quis elementum commodo, nunc lectus elementum mauris, eget vulputate ligula tellus eu neque. Vivamus eu dolor.