

Demo for ML4H 2024: Template

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1. Instructions

This is the template for submissions to the **Demo Track** for the Machine Learning for Health (ML4H) Symposium 2024. Please follow the instructions below:

1. The Demo Track Spec Sheet submission is limited to 2 pages (excluding references and appendices).
2. It must contain the following sections, as outlined in the Call for Demos: Introduction, Method, Results, and Discussion.
3. Please use the packages automatically loaded (amsmath, amssymb, natbib, graphicx, url, algorithm2e) to manage references, write equations, and include figures and algorithms. Please follow the example provided in this file.
4. References must be included in a .bib file.
5. Please write your paper in a single .tex file.
6. For writing guidelines, please see the official ML4H Call for Demos at ml4h.cc.

2. Introduction

This is a sample article that uses the `jmlr` class with the `wcp` class option. Please follow the guidelines in this sample document as it can help to reduce complications when combining the articles into a book. Please avoid using obsolete commands, such as `\rm`, and obsolete packages, such as `epsfig`.¹ Some packages that are known to cause problems for the production editing process are checked for by the `jmlr` class and will generate an error. (If you want to know more about the production editing process, have a look at the video tutorials for the production editors at <http://www.dickimaw-books.com/software/makejmlrbookgui/videos/>.)

Please also ensure that your document will compile with PDF \LaTeX . If you have an error message that's puzzling you, first check for it at the UK TUG FAQ <https://texfaq.org/FAQ-man-latex>. If that doesn't help, create a minimal working example (see <https://www.dickimaw-books.com/latex/minexample/>) and post to somewhere like \TeX on StackExchange (<http://tex.stackexchange.com/>) or the \LaTeX Community Forum (<http://www.latex-community.org/forum/>).

NOTE:

This is an numbered theorem-like environment that was defined in this document's preamble.

2.1. Sub-sections

Sub-sections are produced using `\subsection`.

2.1.1. SUB-SUB-SECTIONS

Sub-sub-sections are produced using `\subsubsection`.

* These authors contributed equally

1. See <http://www.ctan.org/pkg/l2tabu>

53 **Sub-sub-sub-sections** Sub-sub-sub-sections are
 54 produced using `\paragraph`. These are unnumbered
 55 with a running head.

56 **Sub-sub-sub-sub-sections** Sub-sub-sub-sub-
 57 sections are produced using `\subparagraph`. These
 58 are unnumbered with a running head.

59 3. Cross-Referencing

60 Always use `\label` and `\ref` (or one of the com-
 61 mands described below) when cross-referencing.
 62 For example, the next section is Section 4 but you
 63 can also refer to it using Section 4. The `jmlr` class
 64 provides some convenient cross-referencing com-
 65 mands: `\sectionref`, `\equationref`, `\tableref`,
 66 `\figureref`, `\algorithmref`, `\theoremref`,
 67 `\lemmaref`, `\remarkref`, `\corollaryref`,
 68 `\definitionref`, `\conjectureref`, `\axiomref`,
 69 `\exampleref` and `\appendixref`. The argument of
 70 these commands may either be a single label or a
 71 comma-separated list of labels. Examples:

72 Referencing sections: Section 4 or Sections 2 and 4
 73 or Sections 2, 4, 6.1 and 6.2.

74 Referencing equations: Equation (1) or Equa-
 75 tions (1) and (3) or Equations (1), (2), (3) and (4).

76 Referencing tables: Table 1 or Tables 1 and 2 or
 77 Tables 1, 2 and 3.

78 Referencing figures: Figure 1 or Figures 1 and 2 or
 79 Figures 1, 2 and 3 or Figures 3(a) and 3(b).

80 Referencing algorithms: Algorithm 1 or Algo-
 81 rithms 1 and 2 or Algorithms 1, 2 and 3.

82 Referencing theorem-like environments: Theo-
 83 rem 1, Lemma 2, Remark 3, Corollary 4, Definition 5,
 84 Conjecture 6, Axiom 7 and Example 1.

85 Referencing appendices: Appendix A or Appen-
 86 dices A and B.

87 4. Equations

88 The `jmlr` class loads the `amsmath` package, so you can
 89 use any of the commands and environments defined
 90 there. (See the `amsmath` documentation for further
 91 details.²)

92 Unnumbered single-lined equations should be dis-
 93 played using `[` and `\]`. For example:

$$E = mc^2$$

2. Either `texdoc amsmath` or <http://www.ctan.org/pkg/amsmath>

or you can use the `displaymath` environment: 94

$$E = mc^2$$

Numbered single-line equations should be displayed 95
 using the `equation` environment. For example: 96

$$\cos^2 \theta + \sin^2 \theta \equiv 1 \quad (1)$$

This can be referenced using `\label` and 97
`\equationref`. For example, Equation (1). 98

Multi-lined numbered equations should be dis- 99
 played using the `align` environment.³ For example: 100

$$f(x) = x^2 + x \quad (2)$$

$$f'(x) = 2x + 1 \quad (3)$$

Unnumbered multi-lined equations can be displayed 101
 using the `align*` environment. For example: 102

$$\begin{aligned} f(x) &= (x + 1)(x - 1) \\ &= x^2 - 1 \end{aligned}$$

If you want to mix numbered with unnumbered lines 103
 use the `align` environment and suppress unwanted 104
 line numbers with `\nonumber`. For example: 105

$$\begin{aligned} y &= x^2 + 3x - 2x + 1 \\ &= x^2 + x + 1 \end{aligned} \quad (4)$$

An equation that is too long to fit on a single line 106
 can be displayed using the `split` environment. Text 107
 can be embedded in an equation using `\text` or 108
`\intertext` (as used in Theorem 1). See the `ams-` 109
`math` documentation for further details. 110

111 4.1. Operator Names

Predefined operator names are listed in Ta- 112
 ble 1. For additional operators, either use 113
`\operatorname`, for example `\operatorname{var}(X)` or declare it 114
 with `\DeclareMathOperator`, for example 115

`\DeclareMathOperator{\var}{var}` 116

and then use this new command. If you want 117
 limits that go above and below the operator (like 118
`\sum`) use the starred versions (`\operatorname*` or 119
`\DeclareMathOperator*`). 120

3. For reasons why you shouldn't use the obsolete `eqnarray`
 environment, see Lars Madsen, *Avoid eqnarray!* TUGboat
 33(1):21–25, 2012.

Table 1: Predefined Operator Names (taken from amsmath documentation)

<code>\arccos</code>	arccos	<code>\deg</code>	deg	<code>\lg</code>	lg	<code>\projlim</code>	projlim
<code>\arcsin</code>	arcsin	<code>\det</code>	det	<code>\lim</code>	lim	<code>\sec</code>	sec
<code>\arctan</code>	arctan	<code>\dim</code>	dim	<code>\liminf</code>	liminf	<code>\sin</code>	sin
<code>\arg</code>	arg	<code>\exp</code>	exp	<code>\limsup</code>	limsup	<code>\sinh</code>	sinh
<code>\cos</code>	cos	<code>\gcd</code>	gcd	<code>\ln</code>	ln	<code>\sup</code>	sup
<code>\cosh</code>	cosh	<code>\hom</code>	hom	<code>\log</code>	log	<code>\tan</code>	tan
<code>\cot</code>	cot	<code>\inf</code>	inf	<code>\max</code>	max	<code>\tanh</code>	tanh
<code>\coth</code>	coth	<code>\injlim</code>	injlim	<code>\min</code>	min		
<code>\csc</code>	csc	<code>\ker</code>	ker	<code>\Pr</code>	Pr		
		<code>\varlimsup</code>	$\overline{\lim}$	<code>\varinjlim</code>	\varinjlim		
		<code>\varliminf</code>	$\underline{\lim}$	<code>\varprojlim</code>	\varprojlim		

121 5. Vectors and Sets

122 Vectors should be typeset using `\vec`. For example
 123 \mathbf{x} . (The original version of `\vec` can also be accessed
 124 using `\orgvec`, for example \vec{x} .) The `jmlr` class also
 125 provides `\set` to typeset a set. For example \mathcal{S} .

126 6. Floats

127 Floats, such as figures, tables and algorithms, are
 128 moving objects and are supposed to float to the near-
 129 est convenient location. Please don't force them to
 130 go in a particular place. In general it's best to use
 131 the `htbp` specifier and don't put the figure or table in
 132 the middle of a paragraph (that is make sure there's
 133 a paragraph break above and below the float). Floats
 134 are supposed to have a little extra space above and
 135 below them to make them stand out from the rest of
 136 the text. This extra spacing is put in automatically
 137 and shouldn't need modifying.

138 If your article will later be reprinted in the Chal-
 139 lenges for Machine Learning, please be aware that
 140 the CiML books use a different paper size, so if you
 141 want to resize any images use a scale relative to the
 142 line width (`\linewidth`), text width (`\textwidth`)
 143 or text height (`\textheight`).

144 To ensure consistency, please *don't* try changing
 145 the format of the caption by doing something like:

```
146 \caption{\textit{A Sample Caption.}}
```

147 or

```
148 \caption{\em A Sample Caption.}
```

149 You can, of course, change the font for individual
 150 words or phrases, for example:

```
151 \caption{A Sample Caption With Some \emph{Emphasized Words} or below a row using \abovestrut
```

6.1. Tables

Tables should go in the `table` environment. Within
 this environment use `\floatconts` (defined by `jmlr`)
 to set the caption correctly and center the table con-
 tents. The location of the caption depends on the
`tablecaption` setting in the document class options.

Table 2: An Example Table

Dataset	Result
Data1	0.12345
Data2	0.67890
Data3	0.54321
Data4	0.09876

If you want horizontal rules you can use the
`booktabs` package which provides the commands
`\toprule`, `\midrule` and `\bottomrule`. For exam-
 ple, see Table 3.

Table 3: A Table With Horizontal Lines

Dataset	Result
Data1	0.12345
Data2	0.67890
Data3	0.54321
Data4	0.09876

If you really want vertical lines as well, you can't
 use the `booktabs` commands as there'll be some un-
 wanted gaps. Instead you can use L^AT_EX's `\hline`,
 but the rows may appear a bit cramped. You can add
 for below a row using `\abovestrut`

167 and `\belowstrut`. For example, see Table 4. How-
 168 ever, you might want to read the `booktabs` documen-
 169 tation regarding the use of vertical lines.

Table 4: A Table With Horizontal and Vertical Lines

Dataset	Result
Data1	0.12345
Data2	0.67890
Data3	0.54321
Data4	0.09876

170 If you want to align numbers on their decimal
 171 point, you can use the `siunitx` package. For further
 172 details see the `siunitx` documentation⁴.

173 If the table is too wide, you can adjust the inter-
 174 column spacing by changing the value of `\tabcolsep`.
 175 For example:

176 `\setlength{\tabcolsep}{3pt}`

177 If the table is very wide but not very long, you can
 178 use the `sidewaystable` environment defined in the
 179 `rotating` package (so use `\usepackage{rotating}`).
 180 If the table is too long to fit on a page, you can use
 181 the `longtable` environment defined in the `longtable`
 182 package (so use `\usepackage{longtable}`).

183 6.2. Figures

184 Figures should go in the `figure` environment. Within
 185 this environment, use `\floatconts` to correctly po-
 186 sition the caption and center the image. Use
 187 `\includegraphics` for external graphics files but
 188 omit the file extension. Do not use `\epsfig` or
 189 `\psfig`. If you want to scale the image, it's better
 190 to use a fraction of the line width rather than an
 191 explicit length. For example, see Figure 1.



Figure 1: Example Image

192 If your image is made up of L^AT_EX code (for ex-
 193 ample, commands provided by the `pgf` package) you
 194 can include it using `\includeteximage` (defined by

4. Either `texdoc siunitx` or <http://www.ctan.org/pkg/siunitx>

the `jmlr` class). This can be scaled and rotated in the
 same way as `\includegraphics`. For example, see
 Figure 2.

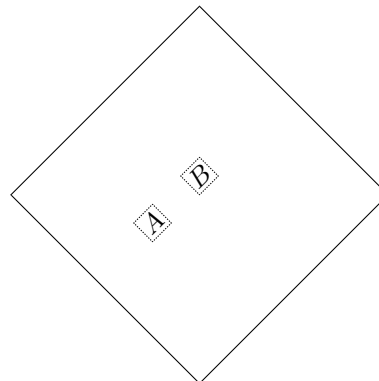


Figure 2: Image Created Using L^AT_EX Code

If the figure is too wide to fit on the page, you can
 use the `sidewaysfigure` environment defined in the
`rotating` package.

Don't use `\graphicspath`⁵. If the im-
 ages are contained in a subdirectory, specify
 this when you include the image, for example
`\includegraphics{figures/mypic}`.

6.2.1. SUB-FIGURES

Sub-figures can be created using `\subfigure`, which
 is defined by the `jmlr` class. The optional argument
 allows you to provide a subcaption. The label should
 be placed in the mandatory argument of `\subfigure`.
 You can reference the entire figure, for example Figure
 3, or you can reference part of the figure using
`\figureref`, for example Figure 3(a). Alternatively
 you can reference the subfigure using `\subfigref`, for
 example (a) and (b) in Figure 3.

By default, the sub-figures are aligned on the base-
 line. This can be changed using the second optional
 argument of `\subfigure`. This may be `t` (top), `c`
 (centered) or `b` (bottom). For example, the subfig-
 ures (a) and (b) in Figure 4 both have `[c]` as the
 second optional argument.

5. This is specific to the `jmlr` class, not a general recommen-
 dation. The main file that generates the proceedings or
 the CiML book is typically in a different directory to the
 imported articles, so it modifies the graphics path when it
 imports an article.

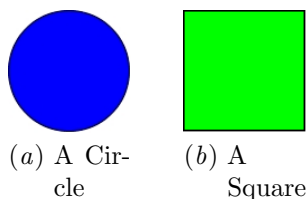


Figure 3: An Example With Sub-Figures.

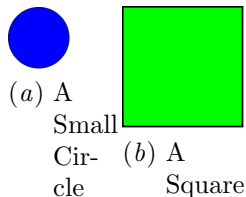


Figure 4: Another Example With Sub-Figures.

221 **6.3. Sub-Tables**

222 There is an analogous command `\subtable` for sub-
 223 tables. It has the same syntax as `\subfigure` de-
 224 scribed above. You can reference the table using
 225 `\tableref`, for example Table 5 or you can refer-
 226 ence part of the table, for example Table 5(a).
 227 Alternatively you can reference the subtable using
 228 `\subtabref`, for example (a) and (b) in Table 5.

Table 5: An Example With Sub-Tables

(a)		(b)	
A	B	C	D
1	2	3	4
		5	6

229 By default, the sub-tables are aligned on the top.
 230 This can be changed using the second optional argu-
 231 ment of `\subtable`. This may be `t` (top), `c` (cen-
 232 tered) or `b` (bottom). For example, the sub-tables
 233 (a) and (b) in Table 6 both have [`c`] as the second
 234 optional argument.

235 **6.4. Algorithms**

236 Enumerated textual algorithms can be displayed us-
 237 ing the `algorithm` environment. Within this envi-
 238 ronment, use `\caption` to set the caption and you
 239 can use an `enumerate` or nested `enumerate` environ-

Table 6: Another Example With Sub-Tables

(a)		(b)	
A	B	C	D
1	2	3	4
		5	6

240 ments. For example, see Algorithm 1. Note that
 241 algorithms float like figures and tables.

Algorithm 1: The Gauss-Seidel Algorithm

1. For $k = 1$ to maximum number of iterations
 - (a) For $i = 1$ to n
 - i. $x_i^{(k)} = \frac{b_i - \sum_{j=1}^{i-1} a_{ij}x_j^{(k)} - \sum_{j=i+1}^n a_{ij}x_j^{(k-1)}}{a_{ii}}$
 - ii. If $\|\mathbf{x}^{(k)} - \mathbf{x}^{(k-1)}\| < \epsilon$, where ϵ is a specified stopping criteria, stop.

If you'd rather have the same numbering through-
 242 out the algorithm but still want the convenient in-
 243 dentation of nested `enumerate` environments, you can
 244 use the `enumerate*` environment provided by the `jmlr`
 245 class. For example, see Algorithm 2. 246

Algorithm 2: Moore's Shortest Path

Given a connected graph G , where the length of each edge is 1:

1. Set the label of vertex s to 0
2. Set $i = 0$
3. Locate all unlabelled vertices adjacent to a vertex labelled i and label them $i + 1$
4. If vertex t has been labelled,
 - the shortest path can be found by back-
 tracking, and the length is given by the
 label of t .
 - otherwise
 increment i and return to step 3

Pseudo code can be displayed using the
 247 `algorithm2e` environment. This is defined by
 248 the `algorithm2e` package (which is automatically
 249

loaded) so check the `algorithm2e` documentation for further details.⁶ For an example, see Algorithm 3.

Algorithm 3: Computing Net Activation

Input: $x_1, \dots, x_n, w_1, \dots, w_n$

Output: y , the net activation

$y \leftarrow 0$;

for $i \leftarrow 1$ **to** n **do**

$y \leftarrow y + w_i * x_i$;

end

7. Description Lists

The `jmlr` class also provides a description-like environment called `altdescription`. This has an argument that should be the widest label in the list. Compare:

add A method that adds two variables.

differentiate A method that differentiates a function.

with

add A method that adds two variables.

differentiate A method that differentiates a function.

8. Theorems, Lemmas etc

The following theorem-like environments are predefined by the `jmlr` class: `theorem`, `example`, `lemma`, `proposition`, `remark`, `corollary`, `definition`, `conjecture` and `axiom`. You can use the `proof` environment to display the proof if need be, as in Theorem 1.

Theorem 1 (Eigenvalue Powers) *If λ is an eigenvalue of \mathbf{B} with eigenvector ξ , then λ^n is an eigenvalue of \mathbf{B}^n with eigenvector ξ .*

Proof *Let λ be an eigenvalue of \mathbf{B} with eigenvector ξ , then*

$$\mathbf{B}\xi = \lambda\xi$$

6. Either `texdoc algorithm2e` or <http://www.ctan.org/pkg/algorithm2e>

premultiply by \mathbf{B} :

$$\begin{aligned} \mathbf{B}\mathbf{B}\xi &= \mathbf{B}\lambda\xi \\ \Rightarrow \mathbf{B}^2\xi &= \lambda\mathbf{B}\xi \\ &= \lambda\lambda\xi && \text{since } \mathbf{B}\xi = \lambda\xi \\ &= \lambda^2\xi \end{aligned}$$

Therefore true for $n = 2$. Now assume true for $n = k$:

$$\mathbf{B}^k\xi = \lambda^k\xi$$

premultiply by \mathbf{B} :

$$\begin{aligned} \mathbf{B}\mathbf{B}^k\xi &= \mathbf{B}\lambda^k\xi \\ \Rightarrow \mathbf{B}^{k+1}\xi &= \lambda^k\mathbf{B}\xi \\ &= \lambda^k\lambda\xi && \text{since } \mathbf{B}\xi = \lambda\xi \\ &= \lambda^{k+1}\xi \end{aligned}$$

Therefore true for $n = k+1$. Therefore, by induction, true for all n . ■

Lemma 2 (A Sample Lemma) *This is a lemma.*

Remark 3 (A Sample Remark) *This is a remark.*

Corollary 4 (A Sample Corollary) *This is a corollary.*

Definition 5 (A Sample Definition) *This is a definition.*

Conjecture 6 (A Sample Conjecture) *This is a conjecture.*

Axiom 7 (A Sample Axiom) *This is an axiom.*

Example 1 (An Example) *This is an example.*

9. Color vs Grayscale

It's helpful if authors supply grayscale versions of their images in the event that the article is to be incorporated into a black and white printed book. With external PDF, PNG or JPG graphic files, you just need to supply a grayscale version of the file. For example, if the file is called `myimage.png`, then the gray version should be `myimage-gray.png` or `myimage-gray.pdf` or `myimage-gray.jpg`. You don't need to modify your code. The `jmlr` class checks

302 for the existence of the grayscale version if it is print
 303 mode (provided you have used `\includegraphics`
 304 and haven't specified the file extension).

305 You can use `\ifprint` to determine which mode
 306 you are in. For example, in Figure 1, the purple el-
 307 lipse represents an input and the yellow ellipse repre-
 308 sents an output. Another example: **important text!**

309 You can use the class option `gray` to see how the
 310 document will appear in gray scale mode. **Colored**
 311 **text** will automatically be converted to gray scale in
 312 print mode.

313 The `jmlr` class loads the `xcolor` package, so you can
 314 also define your own colors. For example: **XYZ**.

315 The `xcolor` class is loaded with the `x11names` op-
 316 tion, so you can use any of the `x11` predefined colors
 317 (listed in the `xcolor` documentation⁷).

I. Guyon, C. Aliferis, and A. Elisseeff. Causal feature
 selection. Technical report, Clopinet, 2007.

Appendix A. First Appendix

This is the first appendix.

Appendix B. Second Appendix

This is the second appendix.

10. Citations and Bibliography

319 The `jmlr` class automatically loads `natbib` and auto-
 320 matically sets the bibliography style, so you don't
 321 need to use `\bibliographystyle`. This sample file
 322 has the citations defined in the accompanying Bib-
 323 TeX file `jmlr-sample.bib`. For a parenthetical cita-
 324 tion use `\citep`. For example (Guyon and Elisseeff,
 325 2003). For a textual citation use `\citet`. For exam-
 326 ple Guyon et al. (2007). Both commands may take a
 327 comma-separated list, for example Guyon and Elis-
 328 seeff (2003); Guyon et al. (2007).

329 These commands have optional arguments and
 330 have a starred version. See the `natbib` documenta-
 331 tion for further details.⁸

332 The bibliography is displayed using
 333 `\bibliography`.

Acknowledgments

335 Acknowledgments go here. Acknowledgments do not
 336 count toward the paper page limit.

References

338 I. Guyon and A. Elisseeff. An introduction to variable
 339 and feature selection. *JMLR*, 3:1157–1182, March
 340 2003.

7. either `texdoc xcolor` or <http://www.ctan.org/pkg/xcolor>

8. Either `texdoc natbib` or <http://www.ctan.org/pkg/natbib>