Full Title of Article
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Abstract

This is the abstract for this article. If you are making your code available, *do not link to it in the abstract since many indexing services will automatically remove or redact the link.* Instead, we are requiring every paper to have an initial statement on data and code availability right after the abstract.

1. Introduction

This is a sample article that uses the jmlr class. 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 PDFLaTeX. 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/).

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

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

1.1. Sub-sections

Sub-sections are produced using `\subsection`.

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

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

2. Cross-Referencing

Always use `\label` and `\ref` (or one of the commands described below) when cross-referencing. For example, the next section is Section 3 but you can also refer to it using Section 3. The jmlr class provides some convenient cross-referencing commands: `\sectionref`, `\equationref`, `\tableref`, `\figureref`, `\algorithmref`, `\theoremref`, `\lemmaref`, `\remarkref`, `\corollaryref`, `\definitionref`, `\conjectureref`, `\axiomref`, `\exampleref` and `\appendixref`. The argument of these commands may either be a single label or a comma-separated list of labels. Examples:

Referencing sections: Section 3 or Sections 1 and 3 or Sections 1, 3, 5.1 and 5.2.

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Referencing equations: Equation (1) or Equations (1) and (3) or Equations (1), (2), (3) and (4).

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

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

Referencing algorithms: Algorithm 1 or Algorithms 1 and 2 or Algorithms 1, 2 and 3.

Referencing theorem-like environments: Theorem 1, Lemma 2, Remark 3, Corollary 4, Definition 5, Conjecture 6, Axiom 7 and Example 1.

Referencing appendices: Appendix A or Appendices A and B.

3. Equations

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

Unnumbered single-lined equations should be displayed using `\[` and `\]`. For example:

$$E = mc^2$$

or you can use the `displaymath` environment:

$$E = mc^2$$

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

$$\cos^2\theta + \sin^2\theta \equiv 1 \tag{1}$$

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

Multi-lined numbered equations should be displayed using the `align` environment.[3] For example:

$$f(x) = x^2 + x \tag{2}$$
$$f'(x) = 2x + 1 \tag{3}$$

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

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

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

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

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

3.1. Operator Names

Predefined operator names are listed in Table 1. For additional operators, either use `\operatorname`, for example var(X) or declare it with `\DeclareMathOperator`, for example

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

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

4. Vectors and Sets

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

5. Floats

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

If your article will later be reprinted in the Challenges for Machine Learning, please be aware that the CiML books use a different paper size, so if you want to resize any images use a scale relative to the

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

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)

\arccos	arccos	\deg	deg	\lg	lg	\projlim	proj lim
\arcsin	arcsin	\det	det	\lim	lim	\sec	sec
\arctan	arctan	\dim	dim	\liminf	lim inf	\sin	sin
\arg	arg	\exp	exp	\limsup	lim sup	\sinh	sinh
\cos	cos	\gcd	gcd	\ln	ln	\sup	sup
\cosh	cosh	\hom	hom	\log	log	\tan	tan
\cot	cot	\inf	inf	\max	max	\tanh	tanh
\coth	coth	\injlim	inj lim	\min	min		
\csc	csc	\ker	ker	\Pr	Pr		

\varlimsup	$\overline{\lim}$	\varinjlim	$\varinjlim$
\varliminf	$\underline{\lim}$	\varprojlim	$\varprojlim$

line width (`\linewidth`), text width (`\textwidth`) or text height (`\textheight`).

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

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

or

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

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

```
\caption{A Sample Caption With Some
\emph{Emphasized Words}.}
```

5.1. 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 contents. 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 example, 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 unwanted gaps. Instead you can use LaTeX's `\hline`, but the rows may appear a bit cramped. You can add extra space above or below a row using `\abovestrut` and `\belowstrut`. For example, see Table 4. However, you might want to read the booktabs documentation 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

If you want to align numbers on their decimal point, you can use the siunitx package. For example, see Table 5. For further details see the siunitx documentation[4].

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

Table 5: A Table With Numbers Aligned on the Decimal Point

Dataset	Result
Data1	0.123 45
Data2	10.6789
Data3	50.543
Data4	200.098 76

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

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

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

5.2. Figures

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



Figure 1: Example Image

If your image is made up of LaTeX code (for example, commands provided by the pgf package) you can include it using `\includeteximage` (defined by the jmlr class). This can be scaled and rotated in the same way as `\includegraphics`. For example, see Figure 2.

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

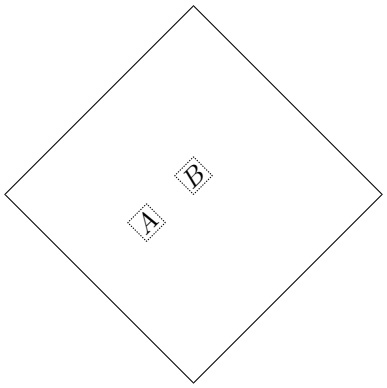
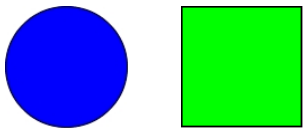


Figure 2: Image Created Using LaTeX Code

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

5.2.1. 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.



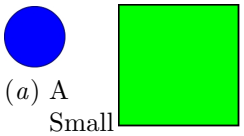
(a) A Circle (b) A Square

Figure 3: An Example With Sub-Figures.

By default, the sub-figures are aligned on the baseline. This can be changed using the second optional argument of `\subfigure`. This may be `t` (top), `c`

5. This is specific to the jmlr class, not a general recommendation. 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.

(centered) or `b` (bottom). For example, the subfigures (*a*) and (*b*) in Figure 4 both have `[c]` as the second optional argument.



(*a*) A Small Circle (*b*) A Square

Figure 4: Another Example With Sub-Figures.

5.3. Sub-Tables

There is an analogous command `\subtable` for sub-tables. It has the same syntax as `\subfigure` described above. You can reference the table using `\tableref`, for example Table 6 or you can reference part of the table, for example Table 6(*a*). Alternatively you can reference the subtable using `\subtabref`, for example (*a*) and (*b*) in Table 6.

Table 6: An Example With Sub-Tables

(*a*)

A	**B**
1	2

(*b*)

C	**D**
3	4
5	6

By default, the sub-tables are aligned on the top. This can be changed using the second optional argument of `\subtable`. This may be `t` (top), `c` (centered) or `b` (bottom). For example, the sub-tables (*a*) and (*b*) in Table 7 both have `[c]` as the second optional argument.

Table 7: Another Example With Sub-Tables

(*a*)

A	**B**
1	2

(*b*)

C	**D**
3	4
5	6

5.4. Algorithms

Enumerated textual algorithms can be displayed using the `algorithm` environment. Within this environment, use `\caption` to set the caption and you can use an `enumerate` or nested `enumerate` environments. For example, see Algorithm 1. Note that 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 $\|\boldsymbol{x}^{(k)} - \boldsymbol{x}^{(k-1)} < \epsilon\|$, where ϵ is a specified stopping criteria, stop.

If you'd rather have the same numbering throughout the algorithm but still want the convenient indentation of nested `enumerate` environments, you can use the `enumerate*` environment provided by the jmlr class. For example, see Algorithm 2.

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 backtracking, 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 `algorithm2e` environment. This is defined by the algorithm2e package (which is automatically loaded) so check the algorithm2e documentation for further details.[6] For an example, see Algorithm 3.

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

Algorithm 3: Computing Net Activation

Input: $x_1, \ldots, x_n, w_1, \ldots, w_n$
Output: y, the net activation
$y \leftarrow 0$;
for $i \leftarrow 1$ **to** n **do**
  $y \leftarrow y + w_i * x_i$;
end

6. 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.

7. 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 $\boldsymbol{B}$ with eigenvector $\boldsymbol{\xi}$, then λ^n is an eigenvalue of $\boldsymbol{B}^n$ with eigenvector $\boldsymbol{\xi}$.*

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

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

premultiply by $\boldsymbol{B}$:

$$\begin{aligned} \boldsymbol{B}\boldsymbol{B}\boldsymbol{\xi} &= \boldsymbol{B}\lambda\boldsymbol{\xi} \\ \Rightarrow \boldsymbol{B}^2\boldsymbol{\xi} &= \lambda\boldsymbol{B}\boldsymbol{\xi} \\ &= \lambda\lambda\boldsymbol{\xi} \qquad \textit{since } \boldsymbol{B}\boldsymbol{\xi} = \lambda\boldsymbol{\xi} \\ &= \lambda^2\boldsymbol{\xi} \end{aligned}$$

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

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

premultiply by $\boldsymbol{B}$:

$$\begin{aligned} \boldsymbol{B}\boldsymbol{B}^k\boldsymbol{\xi} &= \boldsymbol{B}\lambda^k\boldsymbol{\xi} \\ \Rightarrow \boldsymbol{B}^{k+1}\boldsymbol{\xi} &= \lambda^k\boldsymbol{B}\boldsymbol{\xi} \\ &= \lambda^k\lambda\boldsymbol{\xi} \qquad \textit{since } \boldsymbol{B}\boldsymbol{\xi} = \lambda\boldsymbol{\xi} \\ &= \lambda^{k+1}\boldsymbol{\xi} \end{aligned}$$

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.*

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

You can use `\ifprint` to determine which mode you are in. For example, in Figure 1, the purple ellipse represents an input and the yellow ellipse represents an output. Another example: important text!

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

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

The xcolor class is loaded with the `x11names` option, so you can use any of the x11 predefined colors (listed in the xcolor documentation[7]).

9. Citations and Bibliography

The jmlr class automatically loads natbib and automatically sets the bibliography style, so you don't need to use `\bibliographystyle`. This sample file has the citations defined in the accompanying BibTeX file `chil-sample.bib`. For a parenthetical citation use `\citep`. For example (Guyon and Elisseeff, 2003). For a textual citation use `\citet`. For example Guyon et al. (2007). Both commands may take a comma-separated list, for example Guyon and Elisseeff (2003); Guyon et al. (2007).

These commands have optional arguments and have a starred version. See the natbib documentation for further details.[8]

The bibliography is displayed using `\bibliography`.

Acknowledgments

Acknowledgments go here *but should only appear in the camera-ready version of the paper if it is accepted.* Acknowledgments do not count toward the paper page limit.

Data and Code Availability This initial paragraph is **mandatory**. Briefly state what data you use (including citations if appropriate) and whether the data are available to other researchers.[9] If you are not sharing code, you must explicitly state that you are not making your code available. If you are making your code available, then at the time of submission for review, please include your code as supplemental material or as a code repository link; in either case, your code must be **anonymized**. If your paper is accepted, then you should de-anonymize your code for the camera-ready version of the paper. *If you do not include this data and code availability statement for your paper, or you provide code that is not anonymized at the time of submission, then your paper will be desk-rejected.* Your experiments later could refer to this initial data and code availability statement if it is helpful (e.g., to avoid restating what data you use).

Institutional Review Board (IRB) This initial paragraph is **mandatory**. If your research requires IRB approval or has been designated by your IRB as Not Human Subject Research, then at the time of submission for review, you can say that this IRB information will be provided if the paper is accepted. *If you provide IRB information that is not anonymized at the time of submission, then your paper will be desk-rejected.* For the camera-ready version of the paper, you must provide de-anonymized IRB information. If your research does not require IRB approval, then you must state this to be the case.

Statement on AI Usage This initial paragraph is **mandatory**. This statement should disclose any use of AI tools in experimentation, analysis, or manuscript preparation. Spell checkers and grammar suggestions do not need to be disclosed. For each use, state the tool and version, the task, and how the authors verified the output. If no AI tools were used, state "None."

References

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7. either `texdoc xcolor` or http://www.ctan.org/pkg/xcolor
8. Either `texdoc natbib` or http://www.ctan.org/pkg/natbib
9. An example data availability statement: This paper uses the MIMIC-III dataset (Johnson et al., 2016b), which is available on the PhysioNet repository (Johnson et al., 2016a).

Appendix A. First Appendix

This is the first appendix.

Appendix B. Second Appendix

This is the second appendix.