

# R Package **mat2tex**: Easily inject R matrices in $\text{\LaTeX}$ math equations

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<https://github.com/markheckmann/mat2tex>

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## Abstract

This document describes how to use the **mat2tex** package. The **mat2tex** package was written to facilitate the combination of matrices and  $\text{\LaTeX}$  code. **mat2tex** is a mini-language with several operators and functions to allow to combine  $\text{\LaTeX}$  math equation code and R objects, especially matrices, very easily.

*Keywords:* matrix, knitr, R.

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## 1. Quick start

To use **mat2tex** within  $\text{\LaTeX}$  documents install

```
library(devtools)
install_github("mat2tex", "markheckmann")
```

and load the **mat2tex** package.

```
library(mat2tex)
```

It is recommended to add `\usepackage{amsmath}` in the document preamble. Otherwise not all math environments **mat2tex** includes can be used. Now we can start. Let's create the matrix  $A$ .

```
set.seed(1)
A <- matrix(runif(4), 2)
```

To display the matrix wrap the following code in **knitr** chunk with the arguments `echo=FALSE` and `results='asis'`. The following code concatenates the `texcode` chunks using the `%_%` operator. The first chunk adds the math environment `$$` as a string. The second converts the matrix  $A$  into  $\text{\LaTeX}$  code. The last one closes the `$$` environment again.

```
"$$" %_% xm(A) %_% "$$"
```

$$\begin{pmatrix} 0.27 & 0.57 \\ 0.37 & 0.91 \end{pmatrix}$$

You may use the `xx` function to get the same results.

```
xx(A)
```

$$\begin{pmatrix} 0.27 & 0.57 \\ 0.37 & 0.91 \end{pmatrix}$$

Here also, the shorthand `$$` environment is used which is the default in **mat2tex** as it is the standard for RMarkdown files. Working with `.Rnw` files it is convenient to change the default settings to the `\equation` environment to get numerated equations instead by typing

```
mat2tex_options(mathenvir=3)
```

Now we get numerated equations as the default.

```
xx(A)
```

$$\begin{pmatrix} 0.27 & 0.57 \\ 0.37 & 0.91 \end{pmatrix} \tag{1}$$

To reference Equation (2) you may also add a label using the `label` argument. So you can reference it using `\eqref{mylabel}` or `\ref{mylabel}` in your `.Rnw` document.

```
xx(A, label="mylabel")
```

$$\begin{pmatrix} 0.27 & 0.57 \\ 0.37 & 0.91 \end{pmatrix} \tag{2}$$

Let's create one final example. We want to display the values of the singular value decomposition of  $A$ . This time we want to use square brackets and display three digits. To achieve this set the default matrix type to `bmatrix` (the default is `pmatrix`) and to `digits=3`.

```
mat2tex_options(mtype="bmatrix", digits=3)
```

We will use the function `xmt` which is the same as `xm` except that it additionally adds a transpose sign to the matrix.

```
d <- svd(A)
xx("A = UDV^T =", d$u, diag(d$d), xmt(d$v))
```

$$A = UDV^T = \begin{bmatrix} -0.541 & -0.841 \\ -0.841 & 0.541 \end{bmatrix} \begin{bmatrix} 1.167 & 0.000 \\ 0.000 & 0.024 \end{bmatrix} \begin{bmatrix} -0.391 & -0.920 \\ -0.920 & 0.391 \end{bmatrix}^T \quad (3)$$

To find more examples and get more information have a look at the other package vignettes or visit <https://github.com/markheckmann/mat2tex>.

## 2. Math environments

If you included `\usepackage{amsmath}` in the preamble you can make use of several math environments defined in the package. The environments are explained here [https://www.sharelatex.com/learn/Aligning\\_equations\\_with\\_amsmath](https://www.sharelatex.com/learn/Aligning_equations_with_amsmath). To indicate the math environment you can either use the corresponding number or its name (see `?xx`).

*equation and split*

Here you can see that `xx` output can be nested, i.e. math environments can be nested.

```
splt <- xx("AA^T & = ", A, t(A), "\\\\",
           "& =", A %*% t(A), e="split")
xx(splt, e="equation", label="eq1")
```

$$\begin{aligned} AA^T &= \begin{bmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{bmatrix} \begin{bmatrix} 0.266 & 0.372 \\ 0.573 & 0.908 \end{bmatrix} \\ &= \begin{bmatrix} 0.399 & 0.619 \\ 0.619 & 0.963 \end{bmatrix} \end{aligned} \quad (4)$$

*multiline*

Looks ugly here. For demonstration purposes only.

```
xx("AA^T = ", A, t(A), "\\\\",
   " =", A %*% t(A), e=9, label="eq2")
```

$$\begin{aligned} AA^T &= \begin{bmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{bmatrix} \begin{bmatrix} 0.266 & 0.372 \\ 0.573 & 0.908 \end{bmatrix} \\ &= \begin{bmatrix} 0.399 & 0.619 \\ 0.619 & 0.963 \end{bmatrix} \end{aligned} \quad (5)$$

*align*

Sam as *equation* and *split* but each line is numbered.

```
xx("AA^T  &= ", A, t(A), "\\|\\|",
   "&=", A %% t(A), e=5, label="eq3")
```

$$AA^T = \begin{bmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{bmatrix} \begin{bmatrix} 0.266 & 0.372 \\ 0.573 & 0.908 \end{bmatrix} \quad (6)$$

$$= \begin{bmatrix} 0.399 & 0.619 \\ 0.619 & 0.963 \end{bmatrix} \quad (7)$$

*gather*

```
xx("AA^T  = ", A, t(A), "\\|\\|",
   "=", A %% t(A), e=7, label="eq3")
```

$$AA^T = \begin{bmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{bmatrix} \begin{bmatrix} 0.266 & 0.372 \\ 0.573 & 0.908 \end{bmatrix} \quad (8)$$

$$= \begin{bmatrix} 0.399 & 0.619 \\ 0.619 & 0.963 \end{bmatrix} \quad (9)$$

### 3. Matrix types

You can generate different matrix types using the `mtype` argument in `xm`. Available types are defined in the `amsmath` package: `matrix`, `pmatrix`, `bmatrix`, `Bmatrix`, `vmatrix` and `Vmatrix`.

```
xx(xm(A, mtype="matrix"))
```

$$\begin{matrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{matrix} \quad (10)$$

```
xx(xm(A, mtype="pmatrix"))
```

$$\begin{pmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{pmatrix} \quad (11)$$

```
xx(xm(A, mtype="bmatrix"))
```

$$\begin{bmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{bmatrix} \quad (12)$$

To print row and/or column names as well, `bordermatrix` can be used.

```
rownames(A) <- letters[1:2]
colnames(A) <- LETTERS[1:2]
xx(xm(A, mtype="bordermatrix"))
```

$$\begin{array}{cc} & A & B \\ \begin{array}{c} a \\ b \end{array} & \begin{pmatrix} 0.266 & 0.573 \\ 0.372 & 0.908 \end{pmatrix} \end{array} \quad (13)$$

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