# A useful Latex template

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May 14, 2020

**Abstract**

We study an interesting problem in statistics and machine learning.

## 1 Main results

We define two linear maps $\mathcal{D}, \mathcal{F} : \mathbb{R}^{d\times d} \to \mathbb{R}^{d\times d}$, such that for any $\mathbf{A} = (A_{ij}) \in \mathbb{R}^{d\times d}$, we have $[\mathcal{D}(\mathbf{A})]_{ij} := A_{ij}\mathbb{1}_{\{i=j\}}$ and $\mathcal{F}(\mathbf{A}) := \mathbf{A} - \mathcal{D}(\mathbf{A})$. In other words, $\mathcal{D}(\mathbf{A})$ and $\mathcal{F}(\mathbf{A})$ correspond to the diagonal and off-diagonal parts of $\mathbf{A}$ respectively.

*Proof.* Define an event

$$\mathcal{A} := \big\{\|\widetilde{\mathbf{W}} - p^{-2}\mathbf{1}_d\mathbf{1}_d^\top\|_\infty \le p^{-2}\big\}. \tag{1}$$

For $j, k \in [d]$, write $\widehat{P}_{jk} := n^{-1}\sum_{i=1}^n \omega_{ij}\omega_{ik}$. Then by a union bound and Bernstein's inequality, we have

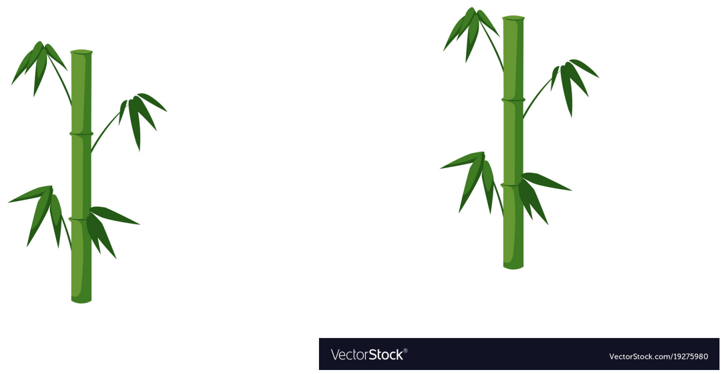
$$\mathbb{P}(\mathcal{A}^{\mathrm{c}}) \le \sum_{j,k\in[d]} \mathbb{P}\big(\widehat{P}_{jk} < p^2/2\big) \le d^2 e^{-3np^2/32}.$$

Note that on $\mathcal{A}$, we have $\|\widetilde{\mathbf{W}}\|_\infty \le 2p^{-2}$. The desired bounds then follow respectively from the following inequalities: $\|\widetilde{\mathbf{W}}\|_{\mathrm{op}} \le d\|\widetilde{\mathbf{W}}\|_\infty$, $\|\widetilde{\mathbf{W}}\|_{1\to1} = \|\widetilde{\mathbf{W}}\|_{\infty\to\infty} \le d\|\widetilde{\mathbf{W}}\|_\infty$, $\|\widetilde{\mathbf{W}}\|_1 \le d^2\|\widetilde{\mathbf{W}}\|_\infty$, $\|\widetilde{\mathbf{W}}\|_{\mathrm{F}} \le d\|\widetilde{\mathbf{W}}\|_\infty$ and $\|\widetilde{\mathbf{W}}\|_{2\to\infty} \le d^{1/2}\|\widetilde{\mathbf{W}}\|_\infty$. □

## 2 Numerical study

The simulation shows significant advantage of Method A over Method B.

Let's make a plot here. Figure 1 compares clipped and original figures.




Clipped                Not Clipped

Figure 1: Bamboos: Should we clip them or not?

Next let's see how we should create tables.

| Methods | RSS | $\|\widehat{\mathbf{\Theta}} - \mathbf{\Theta}^*\|_{\mathrm{F}}$ | $\|\sin\Theta(\widehat{\mathbf{\Theta}}, \mathbf{\Theta}^*)\|_{\mathrm{F}}$ |
|---|---|---|---|
| IHT | 1.008 | 0.018 | 8e-16 |
| Nuclear | 1.006 | 0.033 | 1e-14 |

Table 1: $n = 2000, r = 1, d = 10, k = 1, s = 2, \rho = 0$

Table 1 is a good-looking table. Finally let's cite some papers. Oliveira (2016) may be too hard for undergrads. Rigollet and Hütter (2017) is a nice tutorial on high-dimensional statistics. Pay attention to the format of the cite key, with which I hope you can stick.

## References

Oliveira, R. I. (2016). The lower tail of random quadratic forms with applications to ordinary least squares. *Probability Theory and Related Fields* 1–20.

Rigollet, P. and Hütter, J.-C. (2017). High-dimensional statistics. Tech. rep., Massachusetts Institute of Technology.