

AN EXAMPLE ARTICLE*

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Abstract. In this project we explored various techniques, both used in and out of class to try to accurately predict movie ratings based off of the data set used in lab.

Key words. Movie Recommendation, Decision Trees, SVD

AMS subject classifications. 15A18, 62P20

1. Introduction. The introduction introduces the context and summarizes the manuscript. It is important to clearly state the contributions of this piece of work. The next two paragraphs are text filler, generated by the `lipsum` package.

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The paper is organized as follows. Our main results are in [section 2](#), our new algorithm is in [section 3](#), experimental results are in [section 4](#), and the conclusions follow in [section 6](#).

2. Main results. We interleave text filler with some example theorems and theorem-like items.

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Here we state our main result as [Theorem 2.1](#); the proof is deferred to [??](#).

THEOREM 2.1 (*LDL^T Factorization* [1]). *If $A \in \mathbb{R}^{n \times n}$ is symmetric and the principal submatrix $A(1 : k, 1 : k)$ is nonsingular for $k = 1 : n - 1$, then there exists a*

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unit lower triangular matrix L and a diagonal matrix

$$D = \text{diag}(d_1, \dots, d_n)$$

such that $A = LDL^T$. The factorization is unique.

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THEOREM 2.2 (Mean Value Theorem). *Suppose f is a function that is continuous on the closed interval $[a, b]$. and differentiable on the open interval (a, b) . Then there exists a number c such that $a < c < b$ and*

$$f'(c) = \frac{f(b) - f(a)}{b - a}.$$

In other words,

$$f(b) - f(a) = f'(c)(b - a).$$

Observe that [Theorems 2.1](#) and [2.2](#) and [Corollary 2.3](#) correctly mix references to multiple labels.

COROLLARY 2.3. *Let $f(x)$ be continuous and differentiable everywhere. If $f(x)$ has at least two roots, then $f'(x)$ must have at least one root.*

Proof. Let a and b be two distinct roots of f . By [Theorem 2.2](#), there exists a number c such that

$$f'(c) = \frac{f(b) - f(a)}{b - a} = \frac{0 - 0}{b - a} = 0. \quad \square$$

Note that it may require two L^AT_EX compilations for the proof marks to show.

Display matrices can be rendered using environments from `amsmath`:

$$(2.1) \quad S = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix} \quad \text{and} \quad C = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}.$$

Equation [\(2.1\)](#) shows some example matrices.

We calculate the Fréchet derivative of F as follows:

$$(2.2a) \quad \begin{aligned} F'(U, V)(H, K) &= \langle R(U, V), H\Sigma V^T + U\Sigma K^T - P(H\Sigma V^T + U\Sigma K^T) \rangle \\ &= \langle R(U, V), H\Sigma V^T + U\Sigma K^T \rangle \end{aligned}$$

$$(2.2b) \quad = \langle R(U, V)V\Sigma^T, H \rangle + \langle \Sigma^T U^T R(U, V), K^T \rangle.$$

[Equation \(2.2a\)](#) is the first line, and [\(2.2b\)](#) is the last line.

3. Algorithm. Sed gravida lectus ut purus. Morbi laoreet magna. Pellentesque eu wisi. Proin turpis. Integer sollicitudin augue nec dui. Fusce lectus. Vivamus faucibus nulla nec lacus. Integer diam. Pellentesque sodales, enim feugiat cursus volutpat, sem mauris dignissim mauris, quis consequat sem est fermentum ligula. Nullam justo lectus, condimentum sit amet, posuere a, fringilla mollis, felis. Morbi

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 83 Our analysis leads to the algorithm in [Algorithm 3.1](#).

Algorithm 3.1 Build tree

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Define  $P := T := \{\{1\}, \dots, \{d\}\}$ 
while  $\#P > 1$  do
  Choose  $C' \in \mathcal{C}_p(P)$  with  $C' := \operatorname{argmin}_{C \in \mathcal{C}_p(P)} \varrho(C)$ 
  Find an optimal partition tree  $T_{C'}$ 
  Update  $P := (P \setminus C') \cup \{\bigcup_{t \in C'} t\}$ 
  Update  $T := T \cup \{\bigcup_{t \in \tau} t : \tau \in T_{C'} \setminus \mathcal{L}(T_{C'})\}$ 
end while
return  $T$ 

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92 **4. Experimental results.** Quisque facilisis auctor sapien. Pellentesque gravida
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99 [Figure 1](#) shows some example results. Additional results are available in the
 100 supplement in ??.

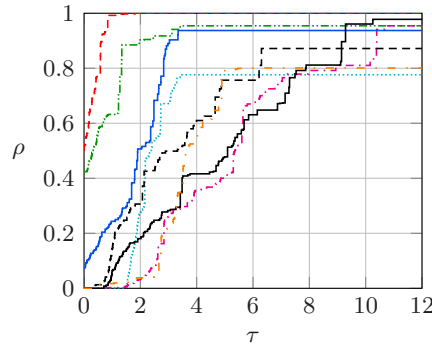


FIG. 1. Example figure using external image files.

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5. Discussion of $Z = X \cup Y$. Curabitur nunc magna, posuere eget, venenatis eu, vehicula ac, velit. Aenean ornare, massa a accumsan pulvinar, quam lorem laoreet purus, eu sodales magna risus molestie lorem. Nunc erat velit, hendrerit quis, malesuada ut, aliquam vitae, wisi. Sed posuere. Suspendisse ipsum arcu, scelerisque nec, aliquam eu, molestie tincidunt, justo. Phasellus iaculis. Sed posuere lorem non ipsum. Pellentesque dapibus. Suspendisse quam libero, laoreet a, tincidunt eget, consequat at, est. Nullam ut lectus non enim consequat facilisis. Mauris leo. Quisque pede ligula, auctor vel, pellentesque vel, posuere id, turpis. Cras ipsum sem, cursus et, facilisis ut, tempus euismod, quam. Suspendisse tristique dolor eu orci. Mauris mattis. Aenean semper. Vivamus tortor magna, facilisis id, varius mattis, hendrerit in, justo. Integer purus.

6. Conclusions. Some conclusions here.

Appendix A. An example appendix. Aenean tincidunt laoreet dui. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Integer ipsum lectus, fermentum ac, malesuada in, eleifend ut, lorem. Vivamus ipsum turpis, elementum vel, hendrerit ut, semper at, metus. Vivamus sapien tortor, eleifend id, dapibus in, egestas et, pede. Pellentesque faucibus. Praesent lorem neque, dignissim in, facilisis nec, hendrerit vel, odio. Nam at diam ac neque aliquet viverra. Morbi dapibus ligula sagittis magna. In lobortis. Donec aliquet ultricies libero. Nunc dictum vulputate purus. Morbi varius. Lorem ipsum dolor sit amet, consectetur adipiscing elit. In tempor. Phasellus commodo porttitor magna. Curabitur vehicula odio vel dolor.

LEMMA A.1. *Test Lemma.*

Acknowledgments. We would like to acknowledge the assistance of volunteers in putting together this example manuscript and supplement.

REFERENCES

- [1] G. H. GOLUB AND C. F. VAN LOAN, *Matrix Computations*, The Johns Hopkins University Press, Baltimore, 4th ed., 2013.