



北京师范大学 珠海校区

BEIJING NORMAL UNIVERSITY AT ZHUHAI

推荐系统 课程简介

马静

github.com/MadelineMa/Recommender-System

github.com/MadelineMa/Recommender-System



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We can read of things that happened
5,000 years ago in the Near East,
where people first learned to write.
But there are some parts of the word
where even now people cannot write.



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01 课程背景简介



- 课程名称：探索性大数据分析之推荐系统
- 推荐系统了解程度？
- 推荐系统直观感受？
- 推荐系统的增长引擎功能？

2019天猫双11 GMV 2684亿元，1%的转化率提升带来26.84亿元。

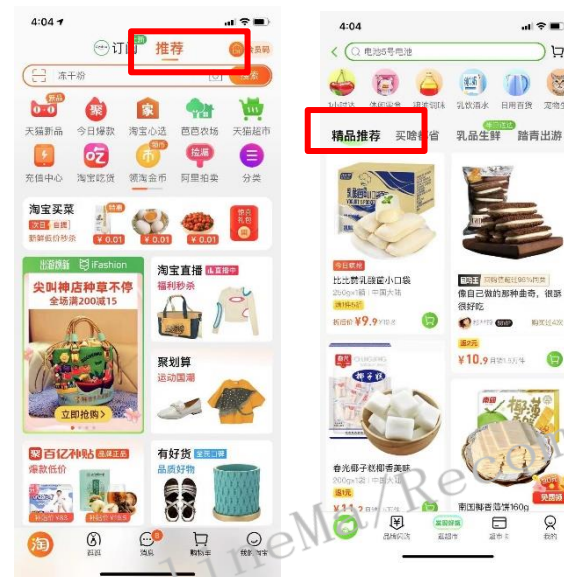
2018手淘惊喜红包，一毛撬动1.6元。

2019手淘618，PUSH带来免费流量1千万。

<https://mp.weixin.qq.com/s/A36Oa81eku0vIX16OIMLOA>

<https://mp.weixin.qq.com/s/q3kSWp5DTgo6i6vp3p9MuQ>

<https://mp.weixin.qq.com/s/2ogCYiQGcmCtSAkPoc5J6g>





课程优势

- 重点区别1: 1992年的传统且基础算法介绍与2015年起始的深度推荐系统研究;
- 重点区别2: 结合阿里巴巴淘系工作经验进行重点内容讲解;
- 深度推荐系统的必要性: 就业面试与科研;
- 自选难度与掌握程度: 传统推荐系统框架, 深度推荐系统框架, 传统算法, 深度学习算法, 编程实现;
- 考核与自选难度保持一致: Survey, 算法的理解+代码实现+ (创新/优化), 无优劣之分;

课程难点

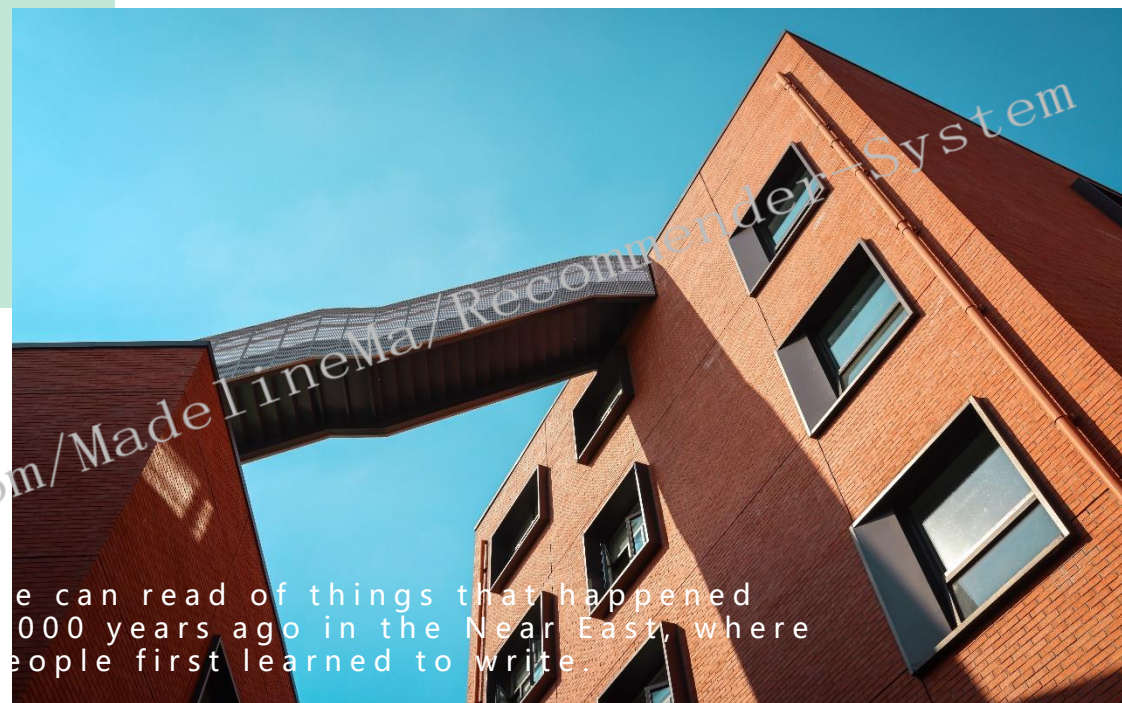
- 随堂给出补充机器学习知识的帖子+课后编程练习, 需要多一些精力才能收获更多!



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02

课程内容与考核





人，货，场的匹配

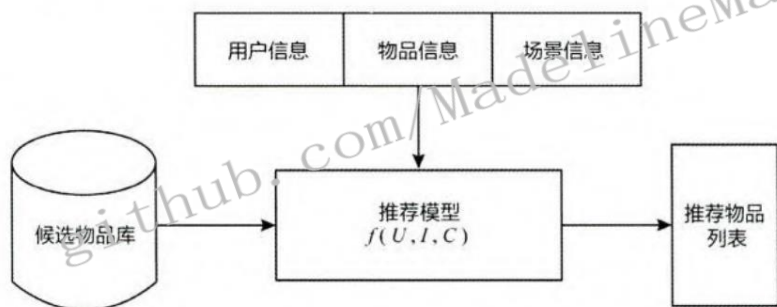


图 1-3 推荐系统逻辑框架

$$S = f(U, I, C) ?$$

系统?

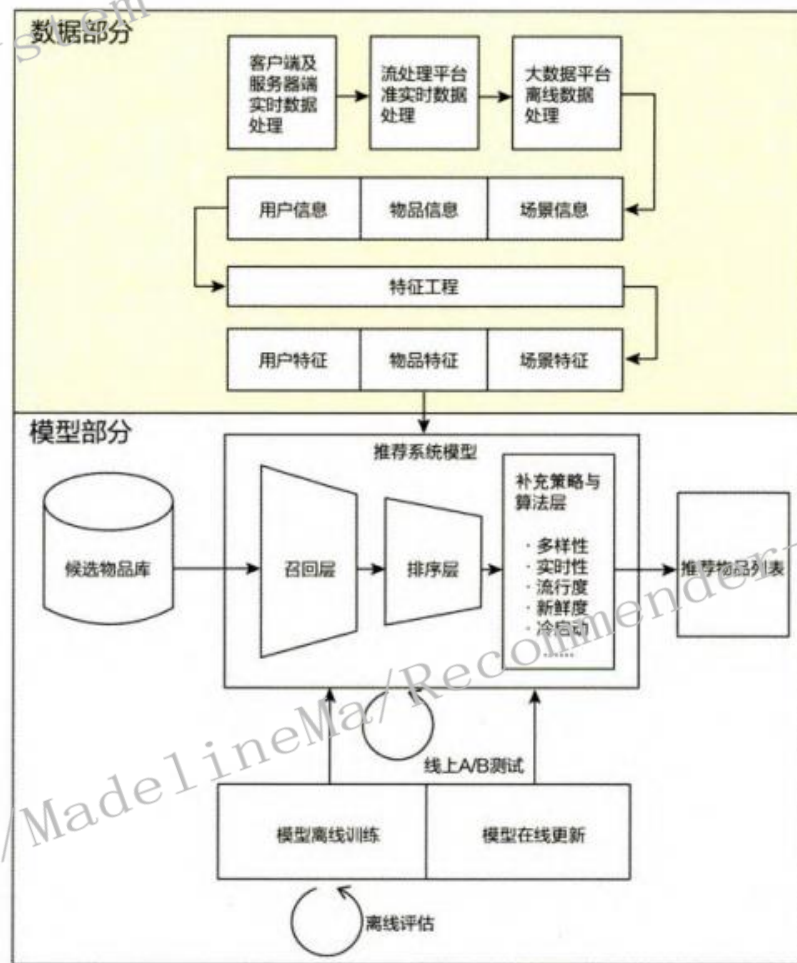


图 1-4 推荐系统的技术架构示意图



原理入门

- Lesson 1: 课程简介
- Lesson 2: 前深度学习时代 30%
- Lesson 3: 前深度学习时代 60%
- Lesson 4: 前深度学习时代 100%
- Lesson 5: 一个深度学习推荐系统的例子
- Lesson 6: 深度机器学习知识补充



实践入门

- Lesson 7: Python入门 50%
- Lesson 8: Python入门 100%
- Lesson 9: Tensorflow入门
- Lesson 10: Tensorflow实践
- Lesson 11: Pytorch入门
- Lesson 12: Pytorch实践



提高

- Lesson 13: 多角度审视推荐系统 30%
- Lesson 14: 多角度审视推荐系统 60%
- Lesson 15: 多角度审视推荐系统 100%
- Lesson 16: 推荐系统评估 50%
- Lesson 17: 推荐系统评估 100%
- Lesson 18: 深度学习在推荐系统中的应用 AutoRec & Deep Crossing
- Lesson 19: 深度学习在推荐系统中的应用 NeuralCF & PNN
- Lesson 20: 深度学习在推荐系统中的应用 WDL & FM
- Lesson 21: 强化学习简介
- Lesson 22: 强化学习在推荐系统中的应用
- Lesson 23-31: 深度学习系统在推荐系统中的应用 14-16组 (学生)
- Lesson 32: 前沿介绍



考核

- 平时成绩40%

小组形式：5-6人一组进行23-31节的报告，每组介绍20分钟，问答5分钟。(survey一个领域/一篇文章精读/一个知识点代码实现)

- 论文成绩60%

个人形式：Survey/科学论文，按论文组织合理性，故事完整性，思考深度进行评分。

- 附加分

书籍、文章、网帖的精华内容，未包含在课程内的surprise项，可酌情加分。

Github的使用：<https://zhuanlan.zhihu.com/p/94008510>

*surprise也是推荐系统的目标



开源数据集

- MovieLens: [浅谈推荐系统+3个小时上手python实现（完整代码） - 知乎 \(zhihu.com\)](#).

地址: [MovieLens | GroupLens](#).

- UCI: 该网站目前维护了436个经典的机器学习、数据挖掘数据集, 包含分类、聚类、回归等问题下的多个数据集。

地址: [UCI Machine Learning Repository](#)

- Kaggle: 全球最大的数据竞赛平台。 [Kaggle如何入门? - 知乎 \(zhihu.com\)](#)

地址: [Find Open Datasets and Machine Learning Projects | Kaggle](#)

- 天池: 阿里旗下数据科学竞赛平台。

地址: [天池大数据众智平台-阿里云天池 \(aliyun.com\)](#)



报告及论文的参考资料

书籍

1. 《深度学习推荐系统》3.8-3.10，第四章，第八章
2. F. Ricci, Lior Rokach, B. Shapira, Recommender Systems: Handbooks, 2nd edition, Springer, 2015
3. M. Zanker, A. Felfernig, and Friedrich, Recommender System: An Introduction, Cambridge University Press, 2010
4. D. K. Agarwal, B.-Chung Chen, Statistical Methods for Recommender Systems, Cambridge University Press, Feb. 2016

embedding

1. 万物皆Embedding，从经典的word2vec到深度学习基本操作item2vec - 知乎 (zhihu.com)
2. Grbovic, Mihajlo, and Haibin Cheng. "Real-Time Personalization Using Embeddings for Search Ranking at Airbnb." Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining, 2018, pp. 311–320.
3. Barkan, Oren, and Noam Koenigstein. "Item2vec: Neural Item Embedding for Collaborative Filtering." RecSys Posters, 2016.



Feature类

1. Rendle, Steffen. "Factorization Machines." 2010 IEEE International Conference on Data Mining, 2010, pp. 995–1000.
2. Guo, H. , et al. "DeepFM: An End-to-End Wide & Deep Learning Framework for CTR Prediction." (2018).
3. Liu, Bin, et al. "AutoFIS: Automatic Feature Interaction Selection in Factorization Models for Click-Through Rate Prediction." Proceedings of the 26th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining, 2020, pp. 2636–2645.

时序信息类

1. Vaswani, Ashish, et al. "Attention Is All You Need." Proceedings of the 31st International Conference on Neural Information Processing Systems, vol. 30, 2017, pp. 5998–6008.
2. Y. Liu, K. Ge, X. Zhang, L. Lin, Real-Time Attention Based Look-alike Models for Recommender Systems, <https://arxiv.org/pdf/1906.05022>
3. Qiwei Chen et al, Behavior Sequence Transformer for E-commerce Recommendation In Alibaba, DLP-KDD'19: Proceedings of the 1st International Workshop on Deep Learning Practice for High-Dimensional Sparse Data, 2019.
4. [3W字长文带你轻松入门视觉transformer - 知乎 \(zhihu.com\)](#) (seq-2-seq, attention, tranformer)
5. Guorui Zou et al, Deep Interest Evolution Network for Click-Through Rate Prediction, AAAI-19
6. W. Zhu, D. Tao, X.Cheng, Multi-intereste Network with Dynamic Routing for Recommendation At Tmall, CIKM '19: The 28th ACM International Conference on Information and Knowledge Management, 2019



Multi-objective

1. Ma, X. , Zhao, L. , Huang, G. , Wang, Z. , Hu, Z. , & Zhu, X. , et al. (2018). Entire Space Multi-Task Model: An Effective Approach for Estimating Post-Click Conversion Rate. ACM. ACM.
2. Ma, J. , Zhe, Z. , Yi, X. , Chen, J. , Hong, L. , & Chi, E. H. . (2018). Modeling Task Relationships in Multi-task Learning with Multi-gate Mixture-of-Experts. ACM.
3. Ruder, Sebastian. “An Overview of Multi-Task Learning in Deep Neural Networks.” ArXiv Preprint ArXiv:1706.05098, 2017.
4. Lin,X.,Chen,H.,Pei,C.,Sun,F.,Xiao,X.,Sun,H.,Zhang,Y.,Ou,W.,andJiang,P.(2019b).A pareto-efficient algorithm for multiple objective optimization in e-commerce recommendation. In Proceedings of the 13th ACM Conference on Recommender Systems, RecSys’19, pages20–28.
5. Milojkovic, Nikola, et al. “Multi-Gradient Descent for Multi-Objective Recommender Systems.” ArXiv: Information Retrieval, 2020.

应用类

1. W. Zhu, D. Tao, X.Cheng, Multi-intereste Network with Dynamic Routing for Recommendation At Tmall,CIKM '19: The 28th ACM International Conference on Information and Knowledge Management, 2019



Graph Neural Network

[graph convolutional network有什么比较好的应用task? - 知乎 \(zhihu.com\)](#)

解释器

[SHAP: Python的可解释机器学习库 - 知乎 \(zhihu.com\)](#)

强化学习基础知识

[强化学习入门 第一讲 MDP - 知乎 \(zhihu.com\)](#)

[强化学习（二）马尔科夫决策过程\(MDP\) - 刘建平Pinard - 博客园 \(cnblogs.com\)](#)

[ICML 2019 | 强化学习用于推荐系统，蚂蚁金服提出生成对抗用户模型 - 知乎 \(zhihu.com\)](#)

[SuttonBartoIPRLBook2ndEd.pdf \(stanford.edu\)](#)

2021顶会文章

[KDD2021推荐系统，计算广告论文汇总 - 知乎 \(zhihu.com\)](#)



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03 教师简介

We can read of things that happened 5,000 years ago in the Near East, where people first learned to write.





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教师简介

马静 教师

北京师范大学数学研究中心.

办公室：励教楼B406

刘子初 助教

北京师范大学统计学院

办公室：励教楼C401

推荐系统课件及资料

github: <https://github.com/MadelineMa/Recommender-System>

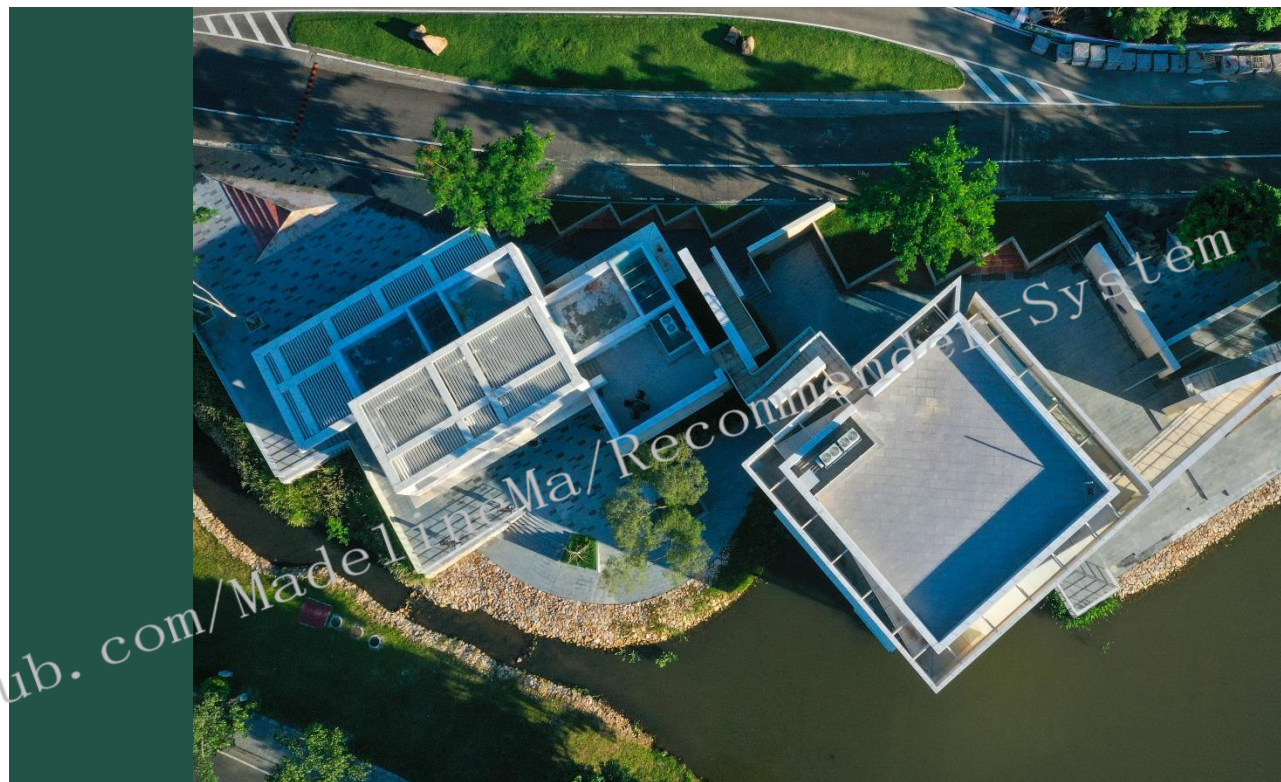
gitee: [_Madeline/Recommender-System \(gitee.com\)](https://gitee.com/MadelineMa/Recommender-System)



04

学生简介

We can read of things that happened 5,000 years ago in the Near East, where people first learned to write.





1. 多刷淘宝 VS 京东 VS 得物 VS B站，与系统交互兴趣，感受推荐力度。
2. 自由组队，依参考文献但不限于参考文献，选择和推荐系统相关的课题准备Report, 给出队员名单和选题题目，方便教师排序。（3周内）
3. 依据兴趣选择继续学习或退课。



Git fork demo

1. Fork 推荐系统课程库信息至自己的git

<https://github.com/MadelineMa/Recommender-System>

2. 将fork的repository实现本地和远程的同步

MadelineMa / Recommender-System

Unwatch 1 Star 0 Fork 0

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master 1 branch 0 tags

Go to file Add file Code

MadelineMa add slides from lesson1 to lesson4 1048045 2 minutes ago 1 commit

Slides add slides from lesson1 to lesson4 2 minutes ago

Help people interested in this repository understand your project by adding a README. Add a README

About

you can download the slides and references you need. Meanwhile, upload your work here.

Releases

No releases published
[Create a new release](#)

Packages



1. Fork 推荐系统课程库信息至自己的git
2. 将fork的repository实现本地和远程的同步
3. 同步完成后，点击Pull requests进行信息提交，教师会完成后续merge

The screenshot shows a GitHub repository page for 'mingjie-liao / MOOP_CODE', which is a fork of 'MadelineMa/MOOP_CODE'. The repository is currently on the 'main' branch, which is 1 commit behind the upstream 'main' branch. The page displays a list of files: 'MMOE/data' (rm adult.test, 2 hours ago), '.gitignore' (rm adult.test, 2 hours ago), and 'README.md' (data preparation, 3 hours ago). The 'Pull requests' tab is highlighted in the navigation bar. The repository has 0 stars and 1 fork.

mingjie-liao / **MOOP_CODE**
forked from MadelineMa/MOOP_CODE

Watch 0 Star 0 Fork 1

<> Code Pull requests Actions Projects Wiki Security Insights Settings

main 1 branch 0 tags

Go to file Add file Code

This branch is 1 commit behind MadelineMa:main. Contribute Fetch upstream

mingjie-liao rm adult.test e7d0372 2 hours ago 3 commits

MMOE/data	rm adult.test	2 hours ago
.gitignore	rm adult.test	2 hours ago
README.md	data preparation	3 hours ago

README.md

MOOP_CODE

About Multi-Objective Optimization Problem
Readme

Releases
No releases published
[Create a new release](#)

Packages
No packages published
[Publish your first package](#)

Languages



国内版本: [Git 大全 - Gitee.com](https://gitee.com/madeline_gitee/Recommender-System)

https://gitee.com/madeline_gitee/Recommender-System

gitee 开源软件 企业版 ^{特惠} 高校版 私有云 博客 我的 ▾

搜开源

Madeline / Recommender-System

Watching 1 Starred 2 **Fork 0**

[代码](#) [Issues 0](#) [Pull Requests 0](#) [Wiki](#) [统计](#) [DevOps](#) [服务](#) [管理](#)

你当前开源项目尚未选择许可证 (LICENSE), [点此选择并创建开源许可](#)

master ▾ 分支 1 标签 0

+ Pull Request + Issue 文件 ▾ Web IDE **克隆/下载 ▾**

M MadelineMa lesson 1 updates b1e6c43 38分钟前 3 次提交

Slides	lesson 1 updates	38分钟前
data	lesson 1-6 updates	1小时前
exercises	lesson 1-6 updates	1小时前

添加一个 README.md 文件, 帮助感兴趣的人了解。 [添加 README](#)

简介

暂无描述

暂无标签

[Python](#)

发行版

暂无发行版, [创建](#)

贡献者 (1) [全部](#)

M



[Git 大全 - Gitee.com](https://gitee.com)

建立本地与远程连接

MINGW64:/d/Mady/github

```
lenovo@LAPTOP-1GEMBOQR MINGW64 /d/Mady/github
$ git clone https://github.com/MadelineMa/Recommender-System.git
Cloning into 'Recommender-System'...
warning: You appear to have cloned an empty repository.

lenovo@LAPTOP-1GEMBOQR MINGW64 /d/Mady/github
$ ls
MLCode/  MLMaterial/  MOOP/  PAPER/  Recommender-System/
```

本地修改：

此电脑 > 新加卷 (D:) > Mady > github > Recommender-System > Slides

名称	修改日期	类型	大小
 lesson1.pptx	2021/6/17 20:39	Microsoft Power...	5,526 KB
 lesson2.pptx	2021/6/16 22:37	Microsoft Power...	5,988 KB
 lesson3.pptx	2021/6/18 17:12	Microsoft Power...	6,926 KB
 lesson4.pptx	2021/6/19 23:10	Microsoft Power...	7,936 KB



同步本地修改至远程

```
lenovo@LAPTOP-1GEMBOQR MINGW64 /d/Mady/github/Recommender-System (master)
$ git add .

lenovo@LAPTOP-1GEMBOQR MINGW64 /d/Mady/github/Recommender-System (master)
$ git status
On branch master

No commits yet

Changes to be committed:
  (use "git rm --cached <file>..." to unstage)
    new file:   Slides/lesson1.pptx
    new file:   Slides/lesson2.pptx
    new file:   Slides/lesson3.pptx
    new file:   Slides/lesson4.pptx

lenovo@LAPTOP-1GEMBOQR MINGW64 /d/Mady/github/Recommender-System (master)
$ git commit -m'add slides from lesson1 to lesson4'
[master (root-commit) 1048045] add slides from lesson1 to lesson4
4 files changed, 0 insertions(+), 0 deletions(-)
create mode 100644 Slides/lesson1.pptx
create mode 100644 Slides/lesson2.pptx
create mode 100644 Slides/lesson3.pptx
create mode 100644 Slides/lesson4.pptx

lenovo@LAPTOP-1GEMBOQR MINGW64 /d/Mady/github/Recommender-System (master)
$ git push
Enumerating objects: 7, done.
Counting objects: 100% (7/7), done.
Delta compression using up to 12 threads
Compressing objects: 100% (6/6), done.
Writing objects: 100% (7/7), 13.32 MiB | 4.29 MiB/s, done.
Total 7 (delta 3), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (3/3), done.
To https://github.com/MadelineMa/Recommender-System.git
 * [new branch]      master -> master
```




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THANKS

DESIGNED BY 2xh