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# Recommender systems: a modern approach

Jakub Nowacki, PhD

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Introduction to Ring



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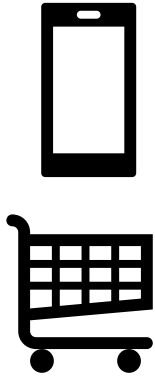
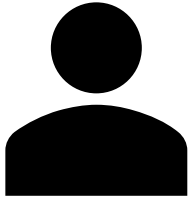


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Our Mission – Making Neighborhoods Safer



What is recommender system?



$f(\text{user}, \text{context}) \approx \text{item}$

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# Types of recommendation

- User personalisation
- Personalised ranking
- Related items
- User segmentation

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Recommendation as a commodity

# Amazon Personalize

<https://aws.amazon.com/personalize/>

powered by  aws

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# Recommendations at Ring

Ring products



Video Doorbells



Alarm 1st GEN



Cams



# Recommendations at Ring

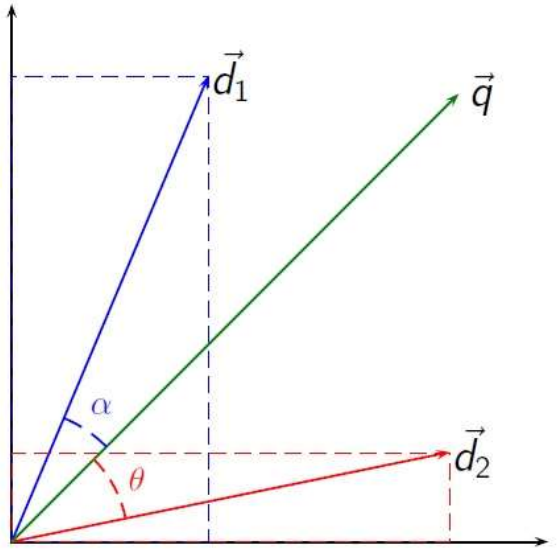
Goal: Suggest products to improve customer experience

What are the challenges?

- Few similar(ish) products
- Very little sale data



# Recommendations at Ring



Source: [https://en.wikipedia.org/wiki/Vector\\_space\\_model](https://en.wikipedia.org/wiki/Vector_space_model)



# Recommendations at Ring

Areas of interest:

- User embedding (representation learning)
- Customer segmentation
- Product recommendations
- High-value actions



Technology



AWS Step Functions

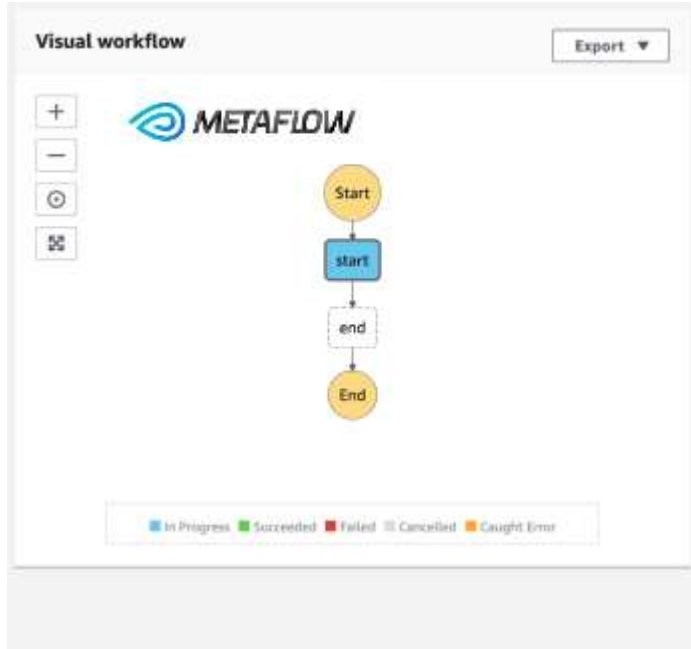


Amazon SageMaker

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# Technology



Source: <https://docs.metaflow.org/going-to-production-with-metaflow/scheduling-metaflow-flows/scheduling-with-aws-step-functions>

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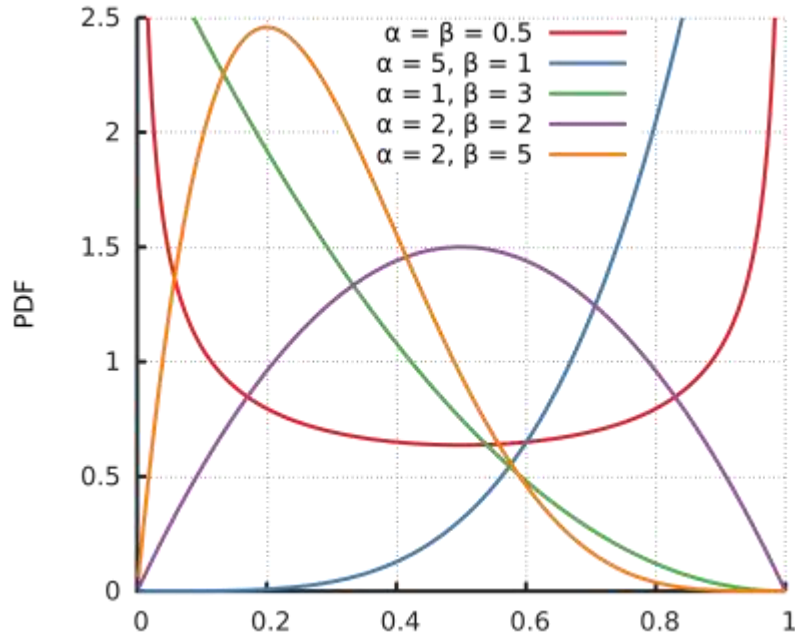
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Recommendations  
Science





# Baselines

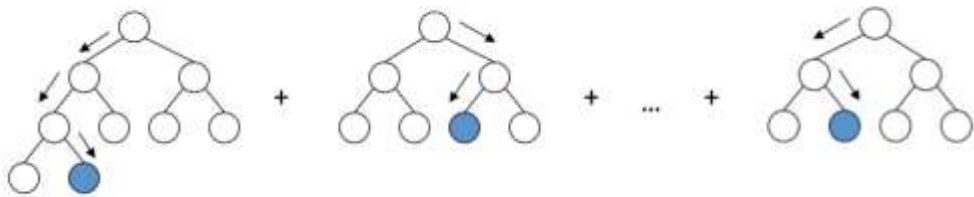


Source: [https://en.wikipedia.org/wiki/Beta\\_distribution](https://en.wikipedia.org/wiki/Beta_distribution)

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# Tabular analysis



Source:

[http://arogozhnikov.github.io/2016/06/24/gradient\\_boosting\\_explained.html](http://arogozhnikov.github.io/2016/06/24/gradient_boosting_explained.html)

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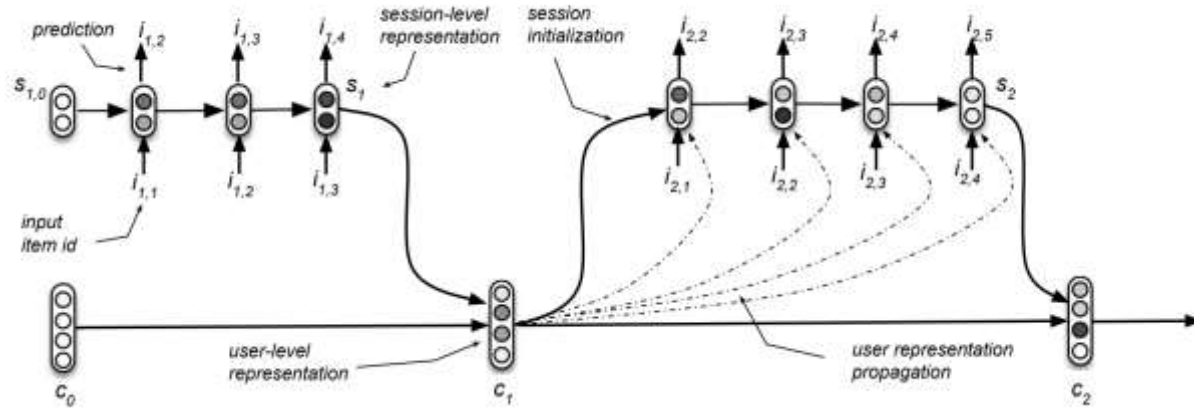
# Sequence analysis

Wonder what's happening while you're not home? With Ring Video Doorbells, peace of mind is always at your fingertips.

1. Detect motion at your front door. [Learn more](#)
2. Receive notifications on your phone. [Learn more](#)
3. See, hear and speak to visitors from anywhere. [Learn more](#)
- With Ring, you're always home. [Learn more](#)



# Recurrent Neural Networks

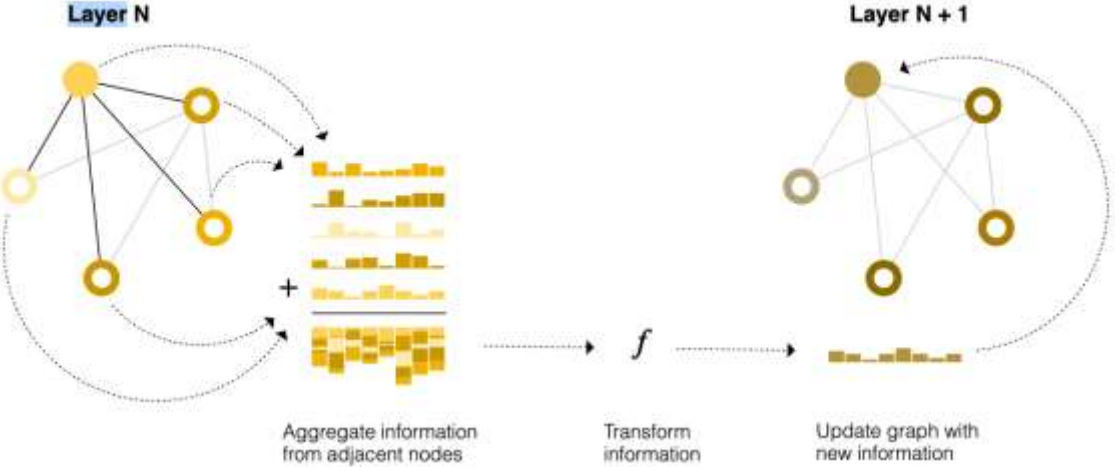


**Source:** Quadrana, Massimo, Alexandros Karatzoglou, Balázs Hidasi, and Paolo Cremonesi. "Personalizing Session-Based Recommendations with Hierarchical Recurrent Neural Networks." In Proceedings of the Eleventh ACM Conference on Recommender Systems, 130–37, 2017. <https://doi.org/10.1145/3109859.3109896>.

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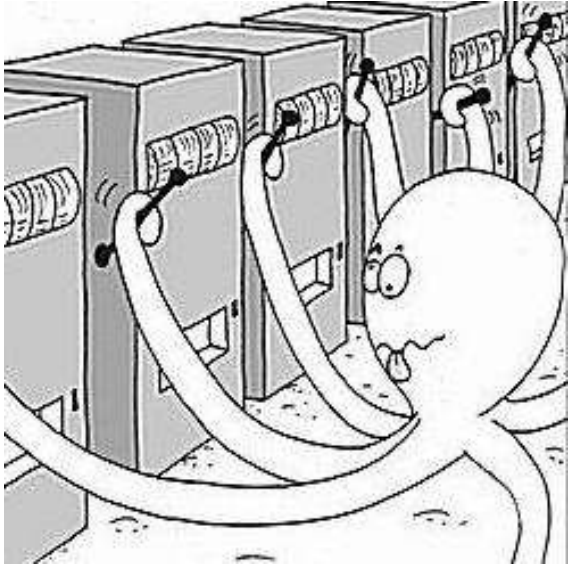
# Graph Neural Networks



Source: <https://distill.pub/2021/gnn-intro/>



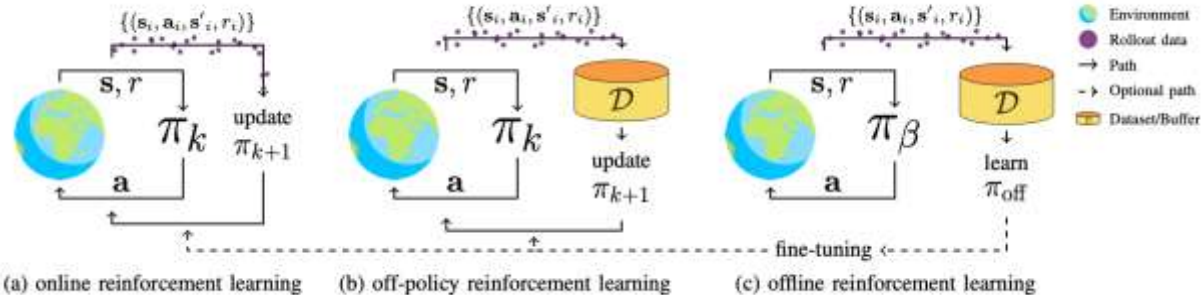
# Multi-Armed Bandits



Source: <https://paperswithcode.com/task/multi-armed-bandits>



# Offline Reinforcement Learning



**Source:** Prudencio, Rafael Figueiredo, Marcos R. O. A. Maximo, and Esther Luna Colombini. "A Survey on Offline Reinforcement Learning: Taxonomy, Review, and Open Problems." arXiv, March 5, 2022. <https://doi.org/10.48550/arXiv.2203.01387>.





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Kudos to Ring Data Science Team!



Chris



Jakub



Greg



Jakub



Michal

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Thank you!

Questions?

