Build a Hotel Recommender Using Amazon Personalize-no PhD Required

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About Me

- AWS ML Hero & Staff Data Scientist at Vrbo, an Expedia Group brand
- Leading Machine Learning initiatives for growth marketing at Vrbo
- Co-creator of Sagify, an open-source CLI tool for SageMaker
- Author of "Hands-On Machine Learning Using Amazon SageMaker" Packt video course
- Main interests: search/ranking, recommenders, personalization, ML platforms
- @PavlosMitsoulis

Challenge

- Help users by providing them a personalized experience given the following constraints:
  - Users don’t purchase (i.e. book) very often compared to other e-commerce platforms
  - Context for each trip might be different within and across different seasons and destinations (e.g. winter trip to mountains with friends, summer trip to the beach with family, etc)
  - Budget is not always consistent for the same traveler

Why Amazon Personalize?

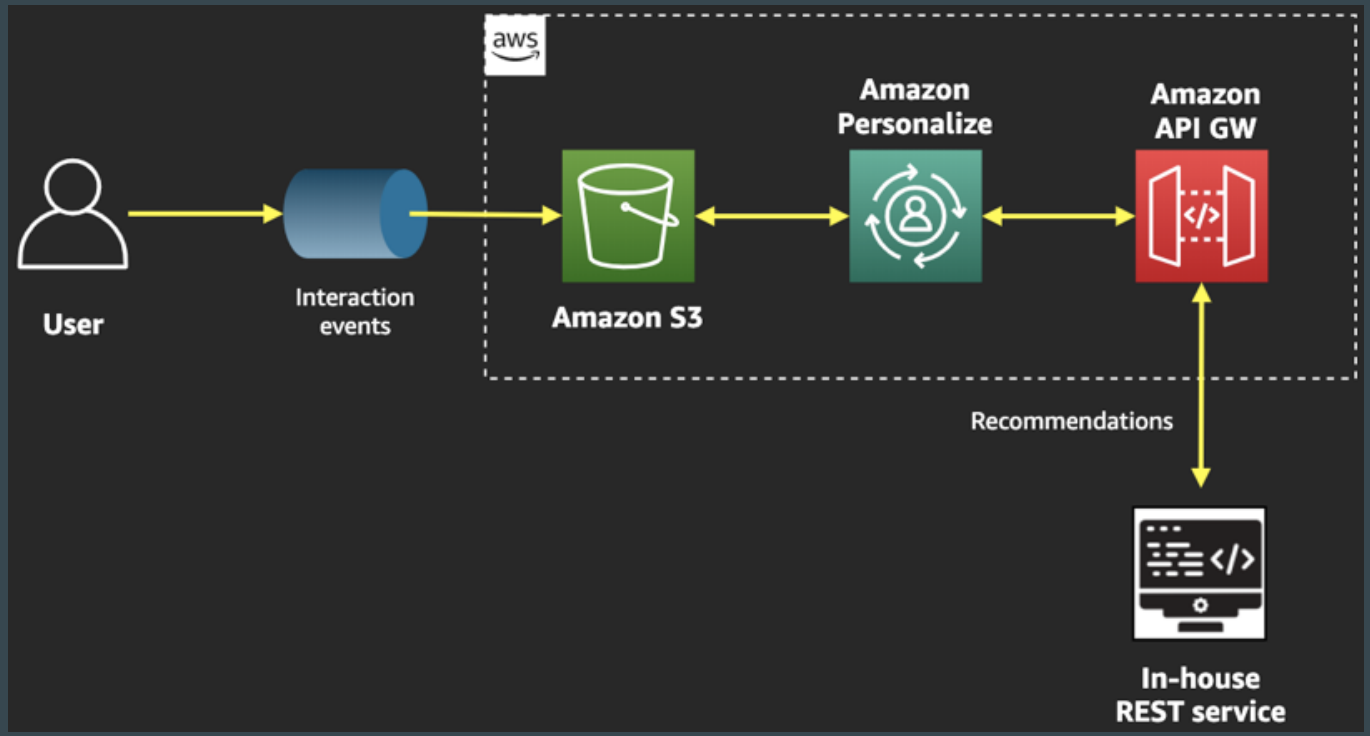
- High quality recommendations, support for HRNN algorithm among others
- Real-time recommendations (interaction events)
- Support for all channels and devices
- Quick personalization models with just a few clicks

Demo!

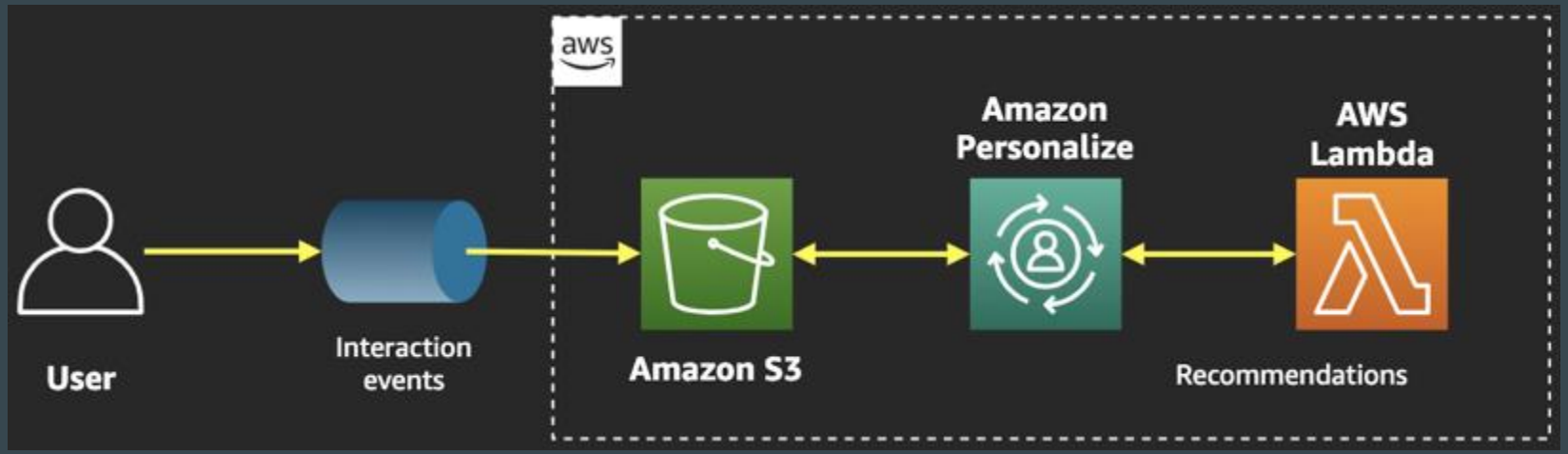
Ways to Improve the Model

- Add User and Item (hotel) features
  - How?
  - Using the HRNN-Metadata Recipe
- HRNN-Coldstart recipe when there are many new users and/or items
- Tune parameters of HRNN recipes

Architecture (1)



Architecture (2)



What is Hierarchical Recurrent Neural Network (HRNN)

- *Personalized Session-based Recommendations with Hierarchical Recurrent Neural Networks* et al M. Quadrana, A. Karatzoglou, B. Hidasi, P. Cremonesi https://arxiv.org/pdf/1706.04148.pdf

What Problem the Authors Solve?

- In Session-based recommenders, recommendations are provided based only on the visitor's interactions in the current session

- But there are cases (such as this one) where a visitor can be logged in or there are other forms of identifiers (cookies)

- How can ”signals” be propagated from “recent” sessions to the current one?

HRNN Algorithm in Simple Words

- Learns a representation embedding from “recent” sessions to inform the current one

- If you’re planning for a ski holiday, you have probably searched in previous recent sessions for hotels in places such as French Alps and viewed hotels in ski areas

- So the algorithm boosts hotels in ski areas in the current session

HRNN Algorithm

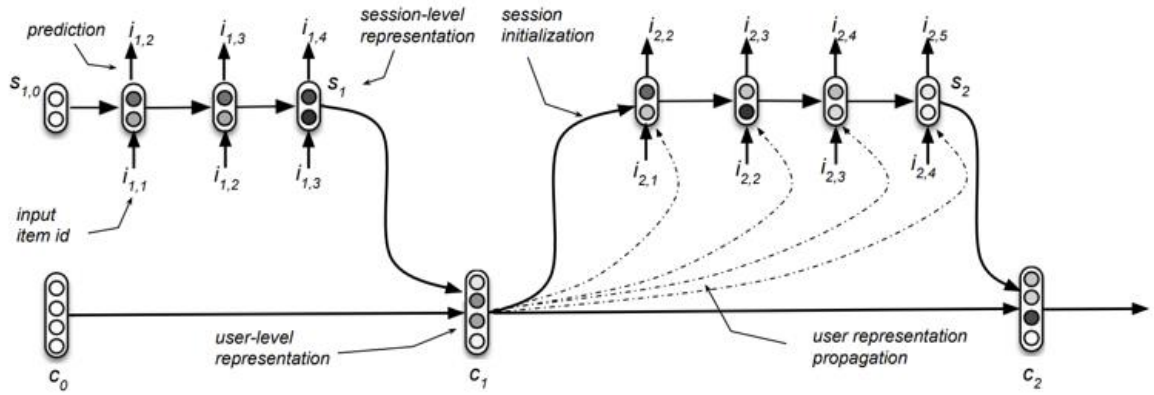


Figure 1: Graphical representation of the proposed Hierarchical RNN model for personalized session-based recommendation. The model is composed of an hierarchy of two GRUs, the session-level GRU (GRU_{ses}) and the user-level GRU (GRU_{usr}). The session-level GRU models the user activity within sessions and generates recommendations. The user-level GRU models the evolution of the user across sessions and provides personalization capabilities to the session-level GRU by initializing its hidden state and, optionally, by propagating the user representation in input.

What about Vacation Rental Industry?

Another Challenge

- # vacation rentals added on your website keeps growing rapidly

Motivation

- Then use HRNN-Coldstart Recipe!
  - An item is considered a cold item when it has the following:
    - Fewer interactions than cold_start_max_interactions
    - A shorter relative duration than cold_start_max_duration

Alternative Approaches

Remember...

- Amazon Personalize provides an easy way to build an accurate recommender for different scenarios with minimal ML knowledge
- Additionally, it solves all the engineering challenges related to training and serving recommendations
- Offers proprietary implementations and optimizations which can be tested across multiple domains
- SIMS algorithm helps with item-item personalization
- However, if you want to have more control in the algorithm...

SageMaker + (LightFM or Spotlight)

- Amazon SageMaker provides an easy way to train and host your custom models
- LightFM and Spotlight are 2 great libraries that provide a Python API to train recommender models based on state-of-the-art methodologies
- And, they give you the ability to make adjustments in the algorithmic part
- https://github.com/lyst/lightfm and https://github.com/maciejkula/spotlight

Github repo

- https://github.com/pm3310/personalize_hotels

Thank You