VOLTRON AI - Group 16

IMPROVE USER EXPERIENCE AND SECURITY OF THE LIBRARY

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SUMMARY

- Customer's request

- Suggested solutions

- Customized recommendations

- Image recognition

- Conclusion

CUSTOMER'S REQUEST

To propose solutions based on artificial intelligence to :

1. **Improve the user experience**

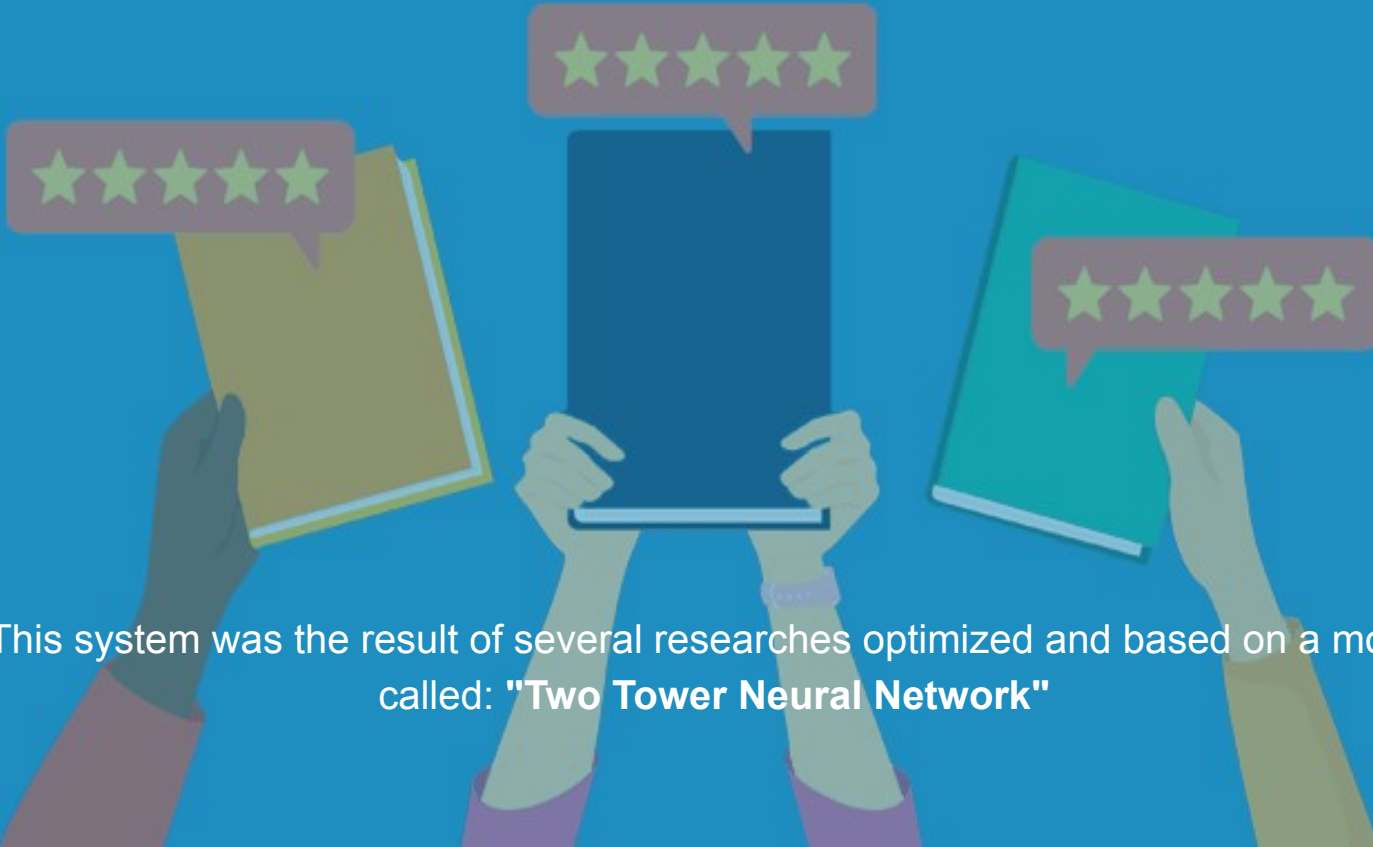2. **Reinforce security within the library.**

SUGGESTED SOLUTIONS

In order to meet the demand, the team proposed :

1. **Customized book recommendation** system based on user's preferences and habits.

2. **Person recognition system** on surveillance cameras to enhance security within the library in case of fire.

CUSTOMIZED RECOMMENDATIONS

This system was the result of several researches optimized and based on a model called: **"Two Tower Neural Network"**

Dataset and preprocessing

Goodbooks-10k dataset : 5.9M ratings given by 53K users to 10K books.

Clean Dataset

No missing values in the dataset

Each column is already in numerical format.
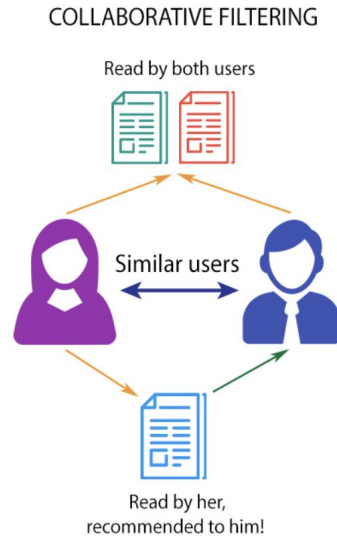
Train / Test split : 80% / 20%

Recommendation systems

A recommender system leverages user data to better understand how they interact with items.
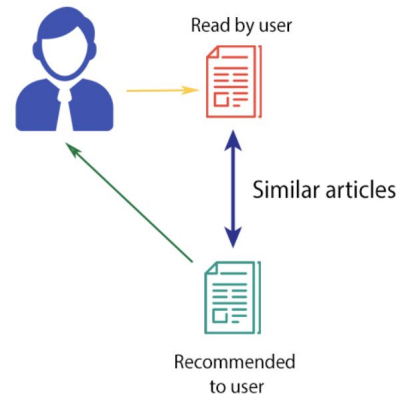
Goal : model a user's behavior regarding targeted items.

Common filtering systems :

COLLABORATIVE FILTERING

CONTENT-BASED FILTERING

Collaborative filtering understands how you interact with items, and then finds other users who behave like you and then recommend to you what these other users like.

Read by both users
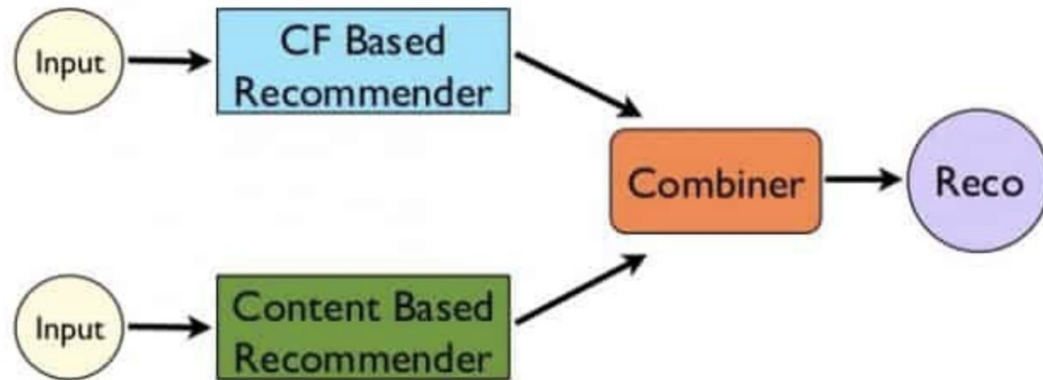
Similar users

Read by her, recommended to him!

Content-based filtering understands the similarity between items, and will recommend items that are similar to the one the user has seen, purchased, or interacted with before.

Read by user

Similar articles

Recommended to user

7

Our approach..

Our filter system is a hybrid approach. It basically combines the strength of both collaborative and content-based approaches.
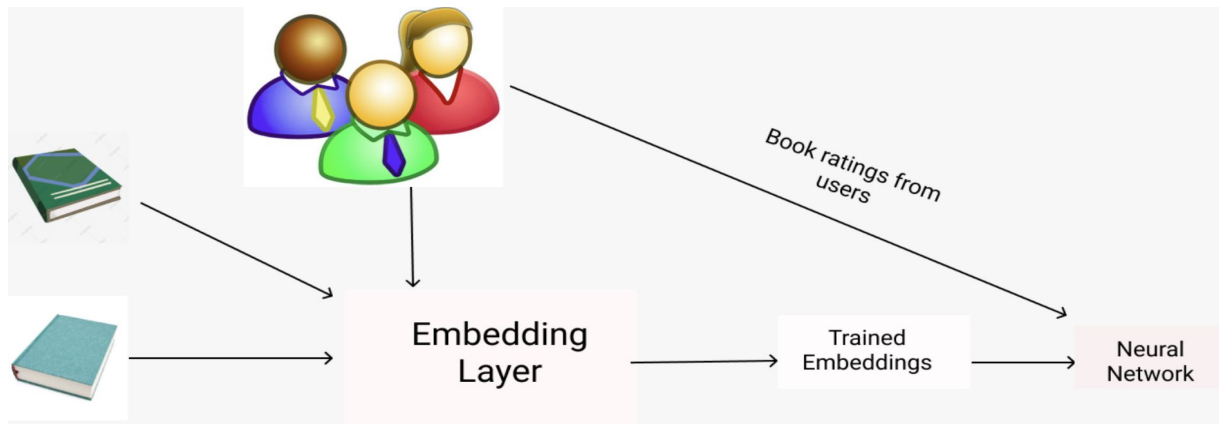

Hybrid Recommendations

How it works ?

We'll use an embedding to build a "profile" of the interactions between users and books and learn their similarities mapping them in an embedding space.

This is a classic regression approach : input is the learned embedding of book-user interaction, and the target/labels are book ratings given by the users.
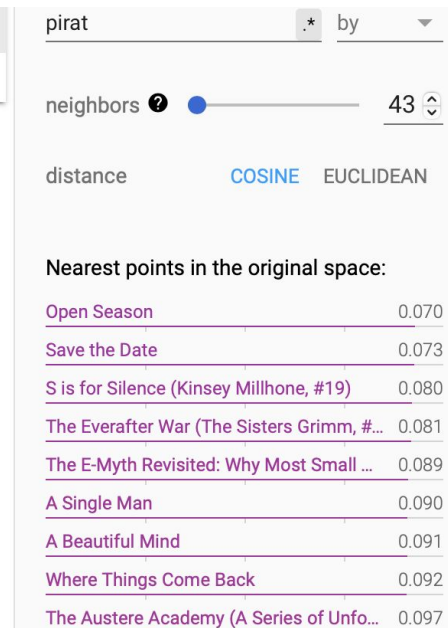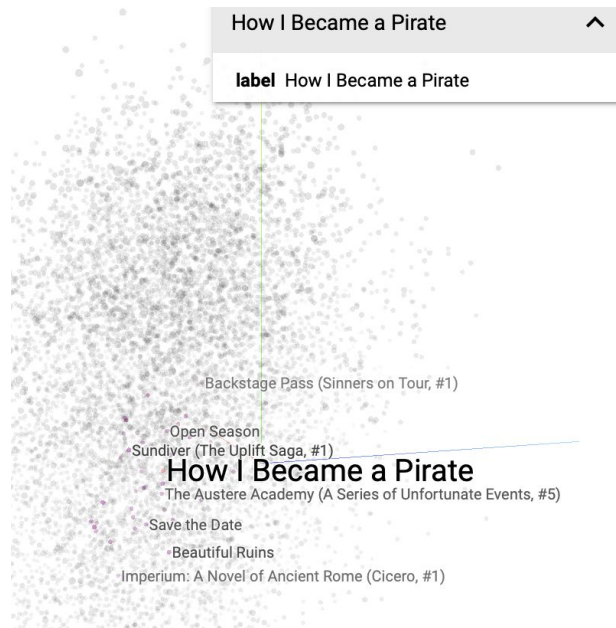
Embedding representation and Embedding space
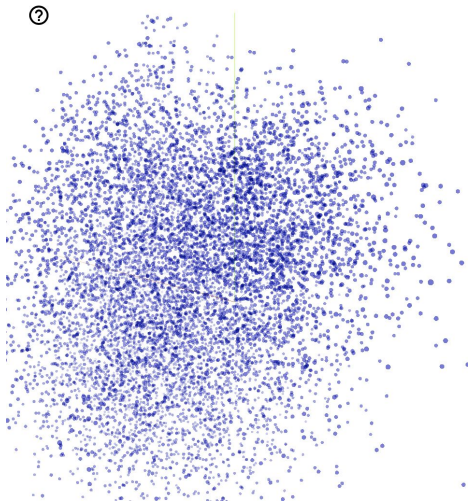
This embedding space helps the neural network better understand the interaction between books and users.
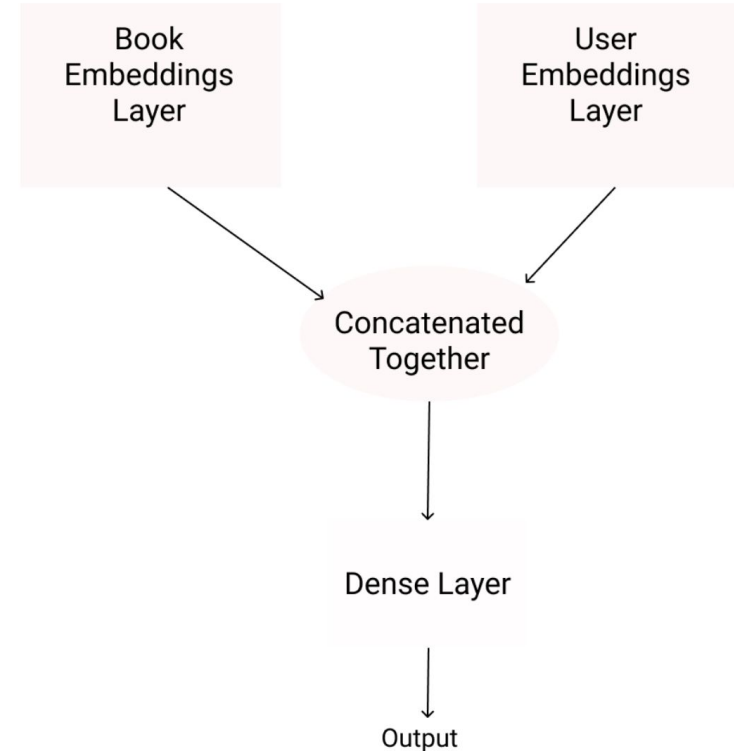
3D Embedding visualisation with Tensorflow Embedding Projector gives us a clue on how books are clustered together in the embedding space.

Two Tower Neural Network

The neural network will have two input embedding layers.

These two embeddings are trained separately and then combined together before being passed to a dense layer.

Prediction and recommendation

Once the model is trained, we can make rating predictions for a specific user.

The model will output an array of ratings for every book.

We retrieve the indexes of the 5 highest rating values in order to get our recommended books metadata.

	book_id	isbn	authors	original_publication_year	original_title	average_rating	image_url
1534	1535	316155608	James Patterson	2006.0	Saving The World and Other Extreme Sports	4.16	https://s.gr-assets.com/assets/nophoto/book/11...
3261	3262	393332144	Patricia Highsmith	1955.0	The Talented Mr. Ripley	3.93	https://s.gr-assets.com/assets/nophoto/book/11...
479	480	440238153	Philip Pullman	2000.0	The Amber Spyglass	4.06	https://images.gr-assets.com/books/1329189152m...
6869	6870	307263940	Anne Tyler	2006.0	Digging to America	3.53	https://images.gr-assets.com/books/1327901292m...
974	975	393322238	Vincent Bugliosi, Curt Gentry	1974.0	Helter Skelter: The True Story of The Manson M...	4.00	https://s.gr-assets.com/assets/nophoto/book/11...

Not only we can make personal recommendations for users with a history, but we can also recommend books to new users by recommending books with the highest average ratings.

IMAGE RECOGNITION

In order to increase security in case of fire, we have extended our study to propose a person recognition system based on "Yolo".

The purpose is to be able to detect the human presence in a room in case of fire and then adjust the steps to follow.

How Yolo works ?

YOLO — You Only Look Once — is an extremely fast multi object detection algorithm which uses convolutional neural network (CNN) to detect and identify objects.
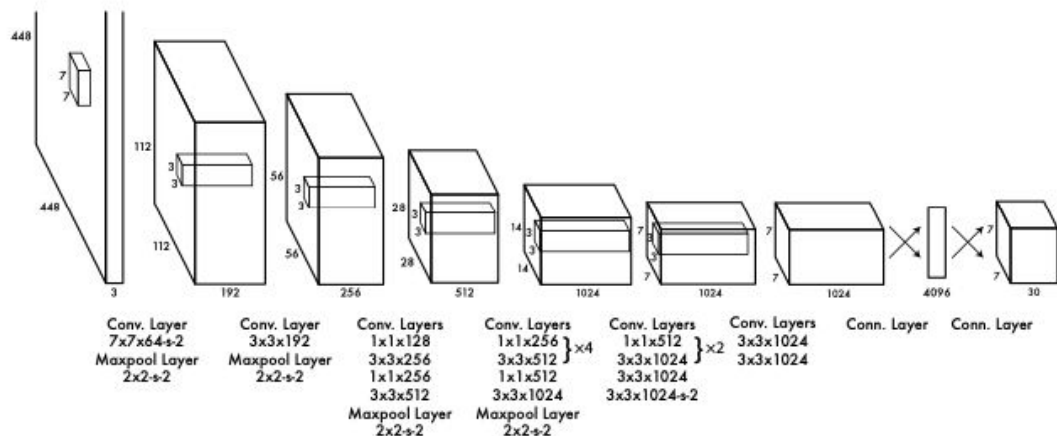
How Yolo works ?

Yolov3 with pre-trained **Coco** dataset which can identify up to 80 objects including people.

1. Frame-by-frame video analysis

2. Create a blob - image transformation to facilitate detection

3. Make predictions on the frame and detect Bounding Box

   One prediction contains :
   - box coordinates : center_x, center_y, width, height
   - box confidence

4. Apply non-maxima suppression to suppress weak,

   overlapping bounding boxes

People detection with Yolo

In our case, we could use the stream of the surveillance cameras to detect human activity.
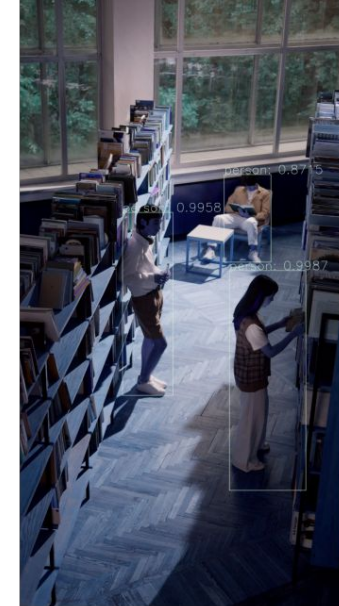
Input : live stream of cameras

Output : video with identifications

⚙ **PROCESSING ...**

- Focus only on people detection

- Minimum confidence of 0.5

- Analysis at 2 fps in our case

- With optimisation and GPU, we can

  reach at the average of 45 fps

CONCLUSION

Thank you for watching this presentation.

Do you have any questions ?