



**Atelier de Machine Learning Semaine 9**

# **Recommender system**

Jeudi 18 avril  
2019

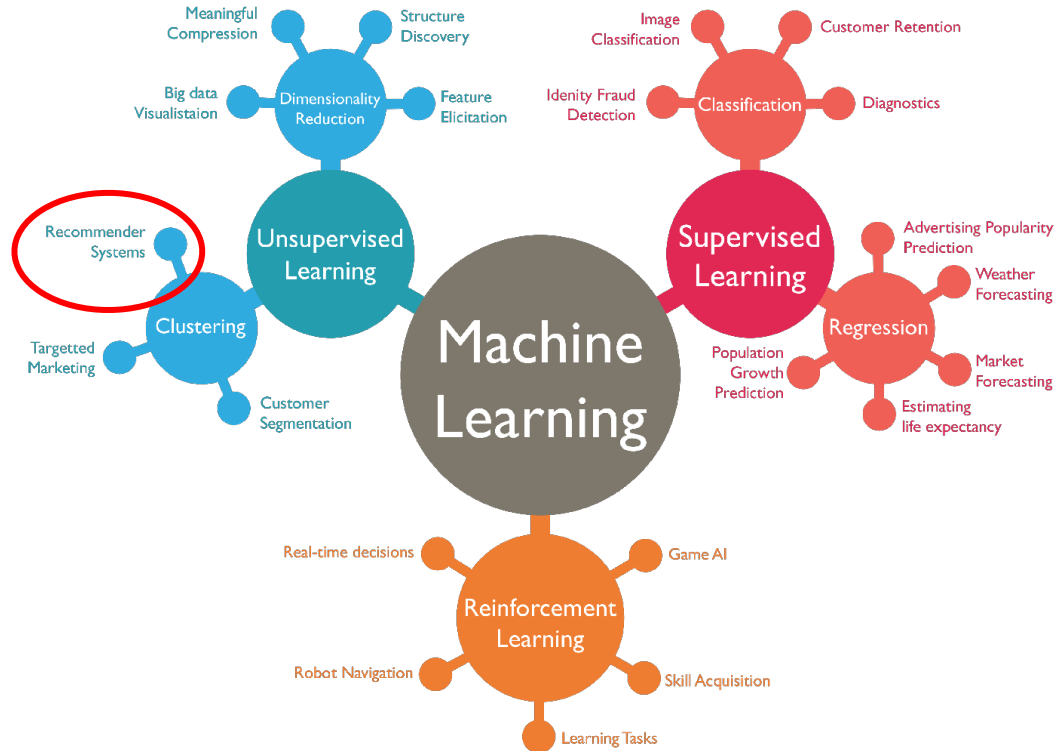
Jaustry & conoel



Pour l'atelier du 2 mai 2019



11 avr	Unsupervised (PCA & k-means)
18 avr	Recommender systems
25 avr	Neural networks (intro)
2 mai	Convolutional neural networks (CNN)
9 mai	Recurrent neural networks (RNN)
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## Liste de recommandations



Netflix Prize



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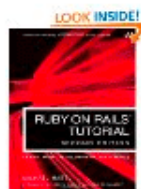
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# Netflix Prize



**grand prize of US\$1,000,000**

**Training set: 100 480 507 notes attribuées par 480 189 utilisateurs à 17 770 films**

**Test set: 1 408 342 évaluations**

# Netflix Prize

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# Collecte de données explicite VS implicite

**Collecte de données explicite – Filtrage actif:** repose sur le fait que l'utilisateur indique explicitement au système ses intérêts.

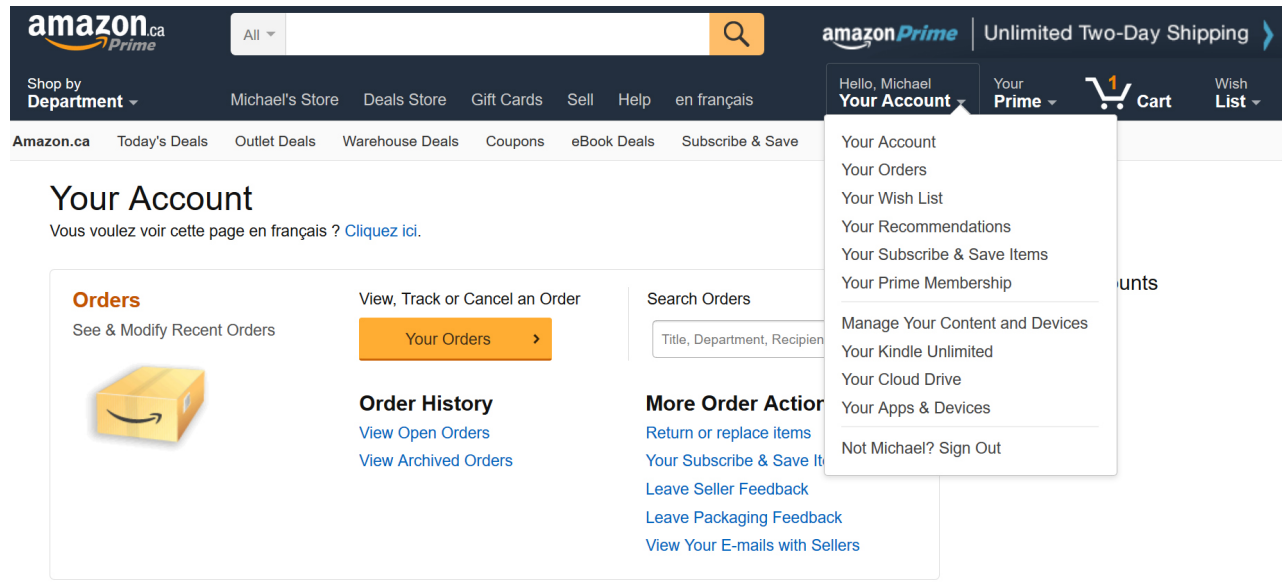
The screenshot shows a 'My Activity' section with a list of TV shows. At the top, there are two tabs: 'Watching' (with a play button icon) and 'Rating' (with a star icon). The 'Rating' tab is highlighted with a red circle. Below the tabs is a table of activity entries. Each entry includes a date, a show title, a star rating, a 'Not Interested' button, and a close button (X). The 'Not Interested' buttons and the close buttons are highlighted with a red box, indicating that explicit user input is used for data collection.

Date	Show Title	Rating	Not Interested	Close (X)
8/16/15	Criminal Minds	3 stars	Not Interested	X
5/11/15	Scandal	5 stars	Not Interested	X
5/2/15	Portlandia	2 stars	Not Interested	X
5/2/15	Flight	5 stars	Not Interested	X
5/2/15	Silver Linings Playbook	5 stars	Not Interested	X
5/1/15	The Birdcage	3 stars	Not Interested	X



# Collecte de données explicite VS implicite

**Collecte de données implicite – Filtrage passif:** repose sur une observation et une analyse des comportements de l'utilisateur effectuées de façon implicite dans l'application qui embarque le système de recommandation, le tout se fait en “arrière-plan” (en gros sans rien demander à l'utilisateur).



The screenshot displays the Amazon.ca website interface. At the top, the Amazon Prime logo is visible alongside a search bar and navigation links. The main header includes the user's name, 'Hello, Michael', and a dropdown menu for 'Your Account'. The 'Your Account' dropdown menu is open, showing a list of options: 'Your Account', 'Your Orders', 'Your Wish List', 'Your Recommendations', 'Your Subscribe & Save Items', 'Your Prime Membership', 'Manage Your Content and Devices', 'Your Kindle Unlimited', 'Your Cloud Drive', 'Your Apps & Devices', and 'Not Michael? Sign Out'. Below the header, the 'Your Account' section is visible, featuring a yellow box icon and a link to 'View, Track or Cancel an Order'. The page also includes a 'Search Orders' section and a 'More Order Action' section with links for returning items, leaving feedback, and viewing emails.

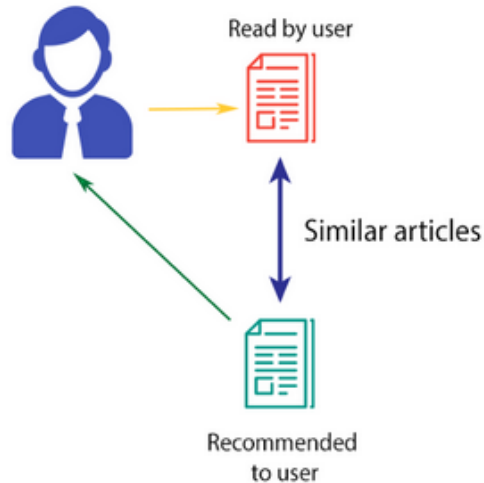


# Les Different modèles

# Recommandation Personnalisée

Il s'agit de recommander des objets sur la base du comportement passé de l'utilisateur.

## CONTENT-BASED FILTERING



# Recommandation Personnalisée

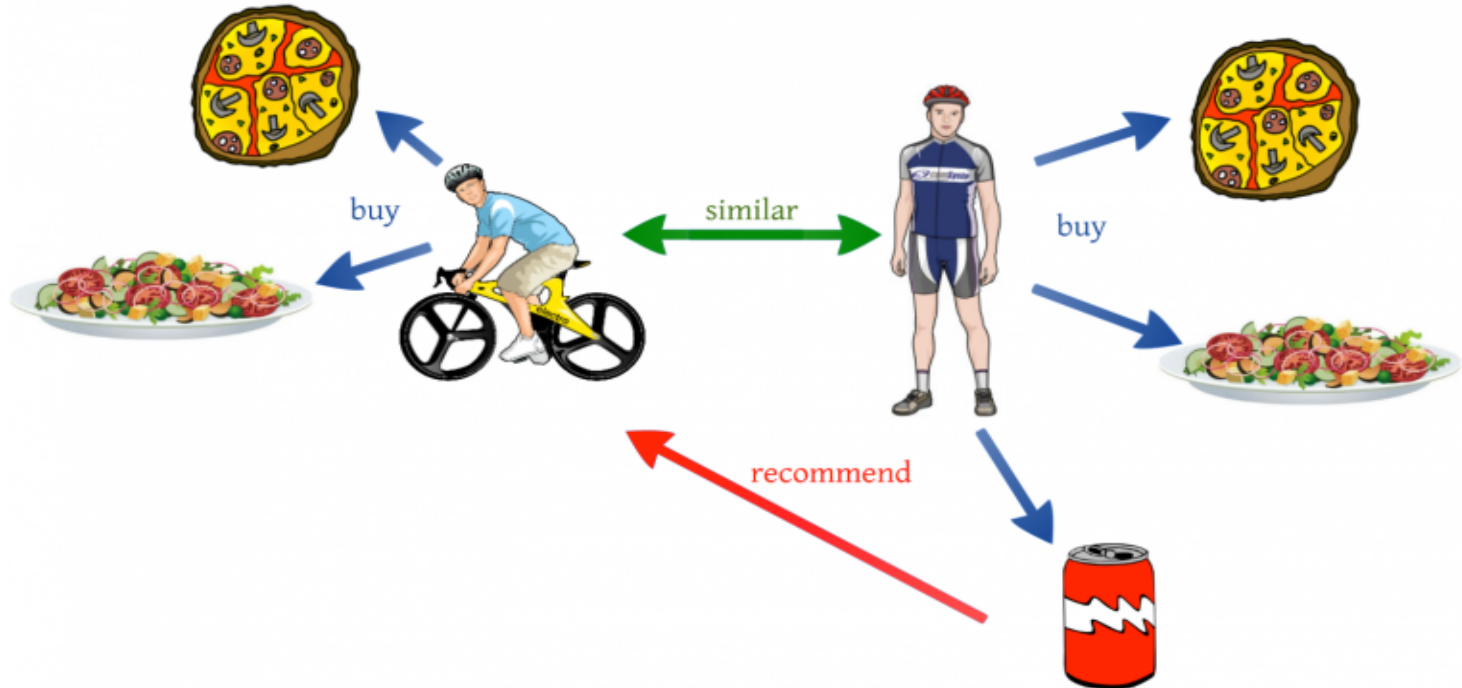


$$\text{sim}(A, B) = \cos(\theta) = \frac{A \cdot B}{\|A\| \|B\|}$$

$$\text{Euclidean Distance} = \sqrt{(x_1 - y_1)^2 + \dots + (x_N - y_N)^2}$$

$$\text{sim}(u, v) = \frac{\sum (r_{ui} - \bar{r}_u)(r_{vi} - \bar{r}_v)}{\sqrt{\sum (r_{ui} - \bar{r}_u)^2} \sqrt{\sum (r_{vi} - \bar{r}_v)^2}}$$

# Recommandation Sociale Personne-Personne



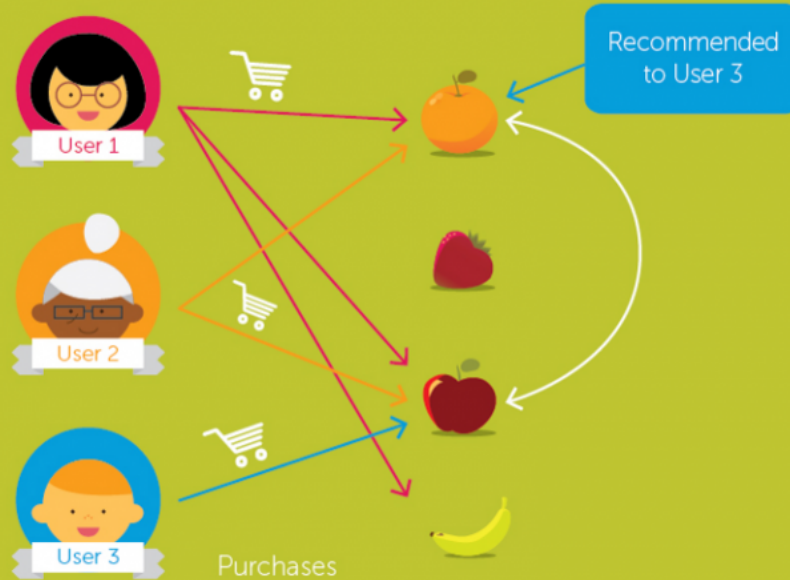
## Recommandation Sociale



$$P_{u,i} = \frac{\sum_v (r_{v,i} * s_{u,v})}{\sum_v s_{u,v}}$$

# Recommendation Sociale objet-objet

## Item-based filtering



## Recommandation Sociale objet-objet



$$P_{u,i} = \frac{\sum_N (s_{i,N} * R_{u,N})}{\sum_N (|s_{i,N}|)}$$

$$sim(i, j) = \cos(\vec{i}, \vec{j}) = \frac{\vec{i} \cdot \vec{j}}{\|\vec{i}\|_2 * \|\vec{j}\|_2}$$



# Recommandation Objet



Title	Genre	Author	Type	Price	Keywords
<i>The Night of the Gun</i>	Memoir	David Carr	Paperback	29.90	press and journalism, drug addiction, personal memoirs, New York
<i>The Lace Reader</i>	Fiction, Mystery	Brunonia Barry	Hardcover	49.90	American contemporary fiction, detective, historical
<i>Into the Fire</i>	Romance, Suspense	Suzanne Brockmann	Hardcover	45.90	American fiction, murder, neo-Nazism
...					

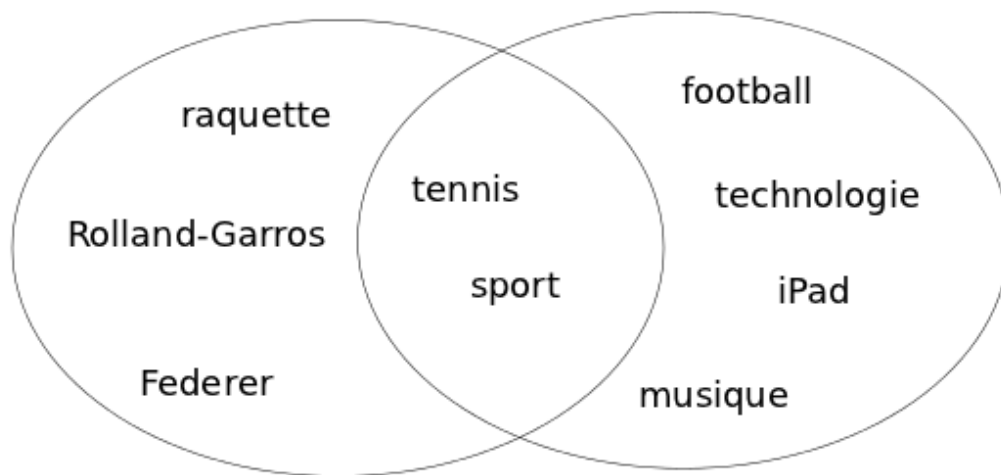
Title	Genre	Author	Type	Price	Keywords
...	Fiction, Suspense	Brunonia Barry, Ken Follett	Paperback	25.65	detective, murder, New York

Profil des livres

Profil/Préférences Utilisateur

# Recommandation Objet

**Objet décrit par des mots-clé**



**Mots-clé préférés de l'utilisateur**

# Recommandation Hybride



# Recommndation Hybride

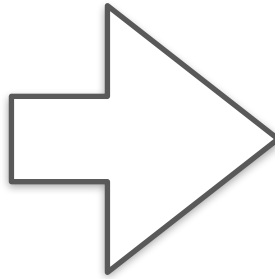
Collaborative filtering

Movie	Rank
A	1
B	0.8
C	0.6
D	0.4
E	0.2

+

Content Based Filtering:

Movie	Rank
B	1
D	0.8
A	0.6
C	0.4
E	0.2



Movie	New Rank
A	$1+0.6 = 1.6$
B	$0.8+1 = 1.8$
C	$0.6+0.4 = 1$
D	$0.4+0.8 = 1.2$
E	$0.2+0.2 = 0.4$

## Efficacité d'un algorithme de recommandation



$$\text{Recall} = \frac{tp}{tp + fn}$$

$$\text{Precision} = \frac{tp}{tp + fp}$$

The end



**APPLAUSE !!**