**Homework 1: Binary Choice**

Due date: 8.11

The goal of this homework is to introduce you to google colab notebooks and simple binary choice problems.

1. Go over the google colab [introduction notebook](https://colab.research.google.com/) and see that you understand the basic components of google colaboratory.
2. Go over the introduction notebook provided and see that you understand the basic components of the training pipeline: user model, population model, training models and metrices. Make sure you get an accuracy higher than 80%.
3. Create the **SigmoidUserModel(UserModel)** class. Like the NoiseUserModel from the introduction notebook, this class models user valuations on items.

The valuation of a user on item is modeled as follows:

Also, create the SigmoidPopulationModel(PopulationModel) accordingly.

Note: use np.random.randn(num\_features) to generate user vectors u, similarly to NoiseUserModel.

1. Create a dataset with the generate\_synth\_data(num\_features, num\_items) function and the SigmoidPopulationModel class you created in section (3). Then run it through a training pipline with the accuracy metric and the LinearRegression() training model. Show the achieved accuracy.
2. Repeat section (4) but with a logistic regression training model.

Note: replace LinearRegression() with MultiOutputClassifier(LogisticRegression()).

1. Run 100 iterations of sections (4)+(5). Meaning in each iterations generate a new dataset with SigmoidPopulationModel and train once with a linear regression model and once with a logistic regression model. Plot a graph of the accuracies in each iteration (2 graphs in the same figure – one for each training model accuracies).
2. Explain the results you got in section (6). Why do you think the graphs look like that?
3. Create the welfare(training\_model, population\_model, model\_args, X) evaluation metric which will be used in our next workshop.

The welfare of users U with respect to items M is defined as follows:

Where f(u, m) is the predicted valuation of the prediction model of user u on item m and

v(u, m) is the true valuation of user u on item m. is the indicator function

().

1. Create the MSE(training\_model, population\_model, model\_args, X) evaluation metric which will be used in our next workshop.

The MSE (mean squared error) of users U with respect to items M is defined as follows:

Submission guidelines:

1. You can (if you want) create a copy of the introduction notebook and fill in your solutions at the end of it.
2. Submit a .ipynb file with your solution.
3. Add a text block in the beginning of your notebook with your IDs.
4. Indicate clearly with a text block the sections of your solutions
5. Answer dry questions in text blocks and wet questions in code blocks.
6. For any questions regarding this homework, contact [Sagi](mailto:sagilevanon@campus.technion.ac.il?subject=HW1).

Example for submission format:

תמונה שמכילה טקסט

התיאור נוצר באופן אוטומטי