Association of products to clients and designated app

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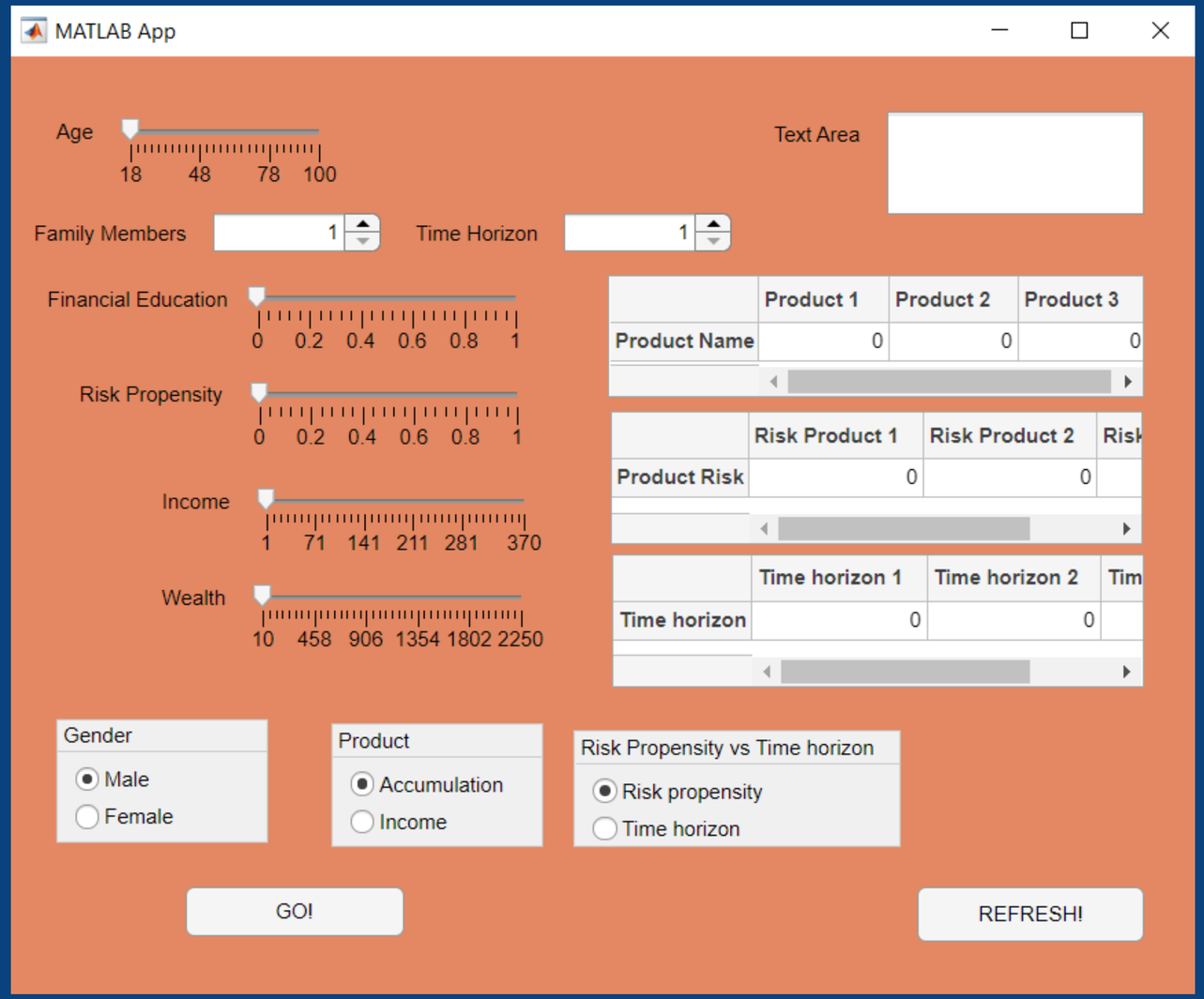
Aim

The goal is to provide a **tool** for a financial advisor which supports him in **suggesting** financial products to his clients



Key steps

1. Assign to each client and product an appropriate **time horizon** of investment
2. Build two supervised **classification models** of clients' needs based on their features
3. Create an **algorithm** which associates clients to their preferred product
4. Build an **app** which represents the desired tool for our financial advisor

Original datasets

Needs

It contains the clients' characteristics:

- Age
- Gender
- Family members
- Financial education
- Risk propensity
- Income
- Wealth
- Income investment
- Accumulation investment

Products

It contains the categories of products offered to the client and their features:

-Type:

0 if income

1 if accumulation

- Risk

Adding Time Horizon

We explored three ways to reasonably assign the variable time horizon of investment to each **client**.

- **Randomly** assign the variable, modeled as a Gaussian (file "Maincodefile.mlx");
- Clustering with **k-medoids** both categorical and numerical features from the dataset Needs and assign a different Time Horizon to each cluster (file "SegmentingClientsTUTTOds.mlx") ;
- Clustering with **k-means** only numerical features from the dataset Needs and assign a different Time Horizon to each cluster (file "SegmentingClientsSOLONUMER.mlx") .

Adding Time Horizon

The criteria we have used in order to assign the time horizon to each **cluster** are the following, in order of importance:

- The **younger** the person, the **greater** the time horizon of investment: this seems reasonable as they have a greater life expectancy than older people;
- The **higher** the **risk** propensity the **greater** the time horizon of investment: for long term investments clients can take on more risk, since the market has many years to recover in the event of a pullback.

However, by performing the two classification models, in each case we obtain **similar results** and no substantial improvements of the prediction quality. Therefore, for simplicity, we opted for the random assignment of Time Horizon.

Adding Time Horizon

We define the Time Horizon of investment as the time period during which the client might invest on the same **category** of products, each one described in the dataset *Products*.
For this reason the time range chosen varies from **1 to 10 years** for clients and **2 to 9 years** in the categories of products. We are not restricting the client to stick on the same product for many years, but we give him the freedom to sell his investment as long as he invests on other products of the same category.
In addition, some of the categories of financial products (i.e. life insurance) require a time horizon of investment that is quite long by definition.
Therefore our choice seems appropriate for our case.

*For the choice of products time horizon see References

Income products

- Income Conservative Unit-Linked (Life Insurance) risk 0.3 time horizon 5y
- Fixed Income Mutual Fund risk 0.12 time horizon 8y
-Balanced High Dividend Mutual Fund risk 0.44 time horizon 7y
- Fixed Income Segregated Account risk 0.13 time horizon 8y
- term deposits risk 0.05 time horizon 2y

Additional type of products: term deposits

We add to the original list of products term deposits in order to associate also clients with very low risk propensity, since to advice a product to a clients, produtc's risk needs to be lower than client's risk propensity

Accumulation products

- Balanced Mutual Fund risk 0.55 time horizon 5
- Balanced Mutual Fund risk 0.41 time horizon 5
- Defensive Flexible Allocation Unit-Linked (Life Insurance) risk 0.36 time horizon 4
- Aggressive Flexible Allocation Unit-Linked (Life Insurance) risk 0.75 time horizon 7
- Balanced Flexible Allocation Unit-Linkled (Life Insurance) risk 0.48 time horizon 5
- Cautious Allocation Segregated Account risk 0.27 time horizon 6
- Total Return Aggressive Allocation Segregated Account risk 0.88 time horizon 9

Classification models

We build two models: one for the classification of Accumulation Need and another for Income Need.
The models built are two **bagged trees** optimized with **Bayesian optimization.**

They include the numerical scaled variables Age, Financial education, Risk propensity, Income & Wealth ratio and Time horizon, and the log trasformations of Income and Wealth. We consider a **training set** of 75% of the whole dataset and the remaining part as the **testing set**.

Association client-products

We create an algorithm which associates clients to their preferred product (accumulation or income) with respect to **time horizon** and **risk propensity**. First, the algorithm checks that the client's risk propensity is higher than the minimun risk of the products of the respective category (income or accumulation) then it associates to clients the reccomended ones (max 3).

We add to the products also term deposits, which have a very low risk, in order to find a suitable product also for clients with a lower risk propensity. This is an alternative for both, accumulation and income clients.

Products recommendation

Risk propensity

In case of more than 3 products with risk lower than the client's risk propensity, the code associates the **3 riskiest ones**.
Otherwise the algorithm associates all the suitable products.

Time horizon

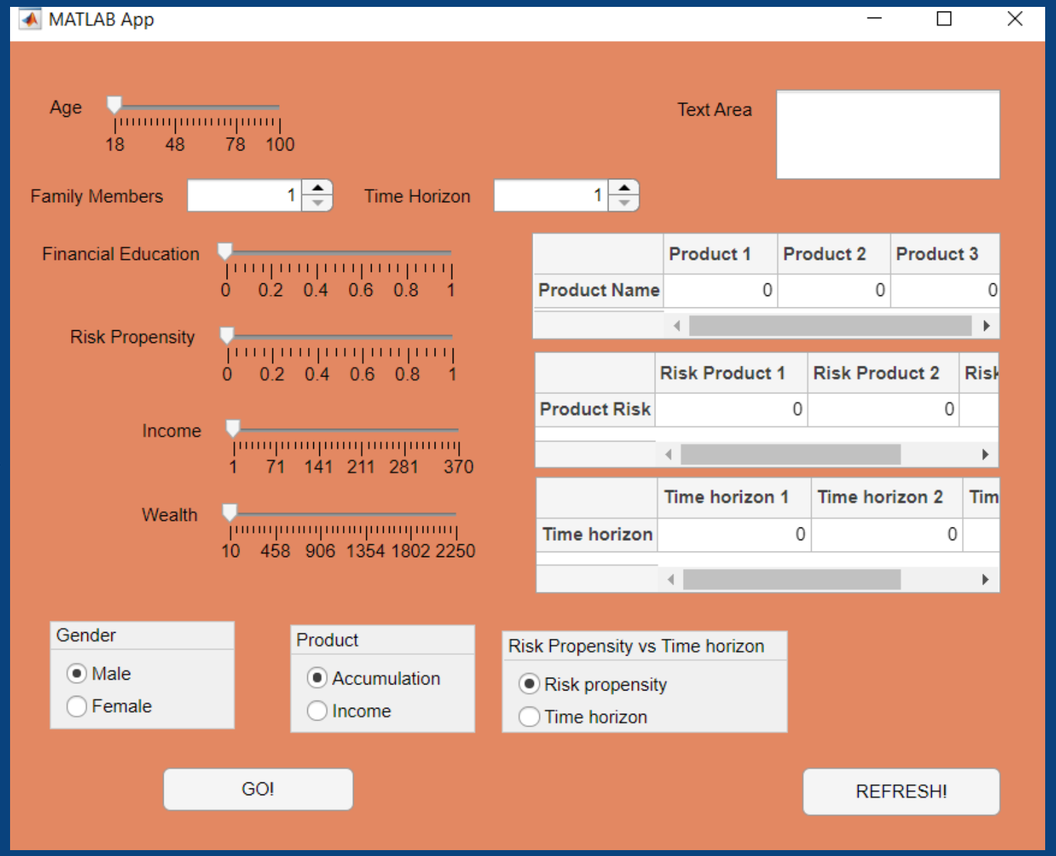
In case of more than 3 products with risk lower than the client's risk propensity, the code associates the **3 products with minimun difference between time client's and products' time horizon.**
Otherwise the algorithm associates all the suitable products.

The app

We have implemented a Matlab application which, received the client features as input, returns the most suitable products for him/her.

Input: the same charateristics of the original dataset plus time horizon and Risk propensity vs time horizon.

Output: associated products by using an algorithm similar to the one in *maincodefile.mlx,* with a maximum of 3 products per client.



Risk propensity vs time horizon represents the choice of the clients to order the products with respect to time horizon or risk propensity.

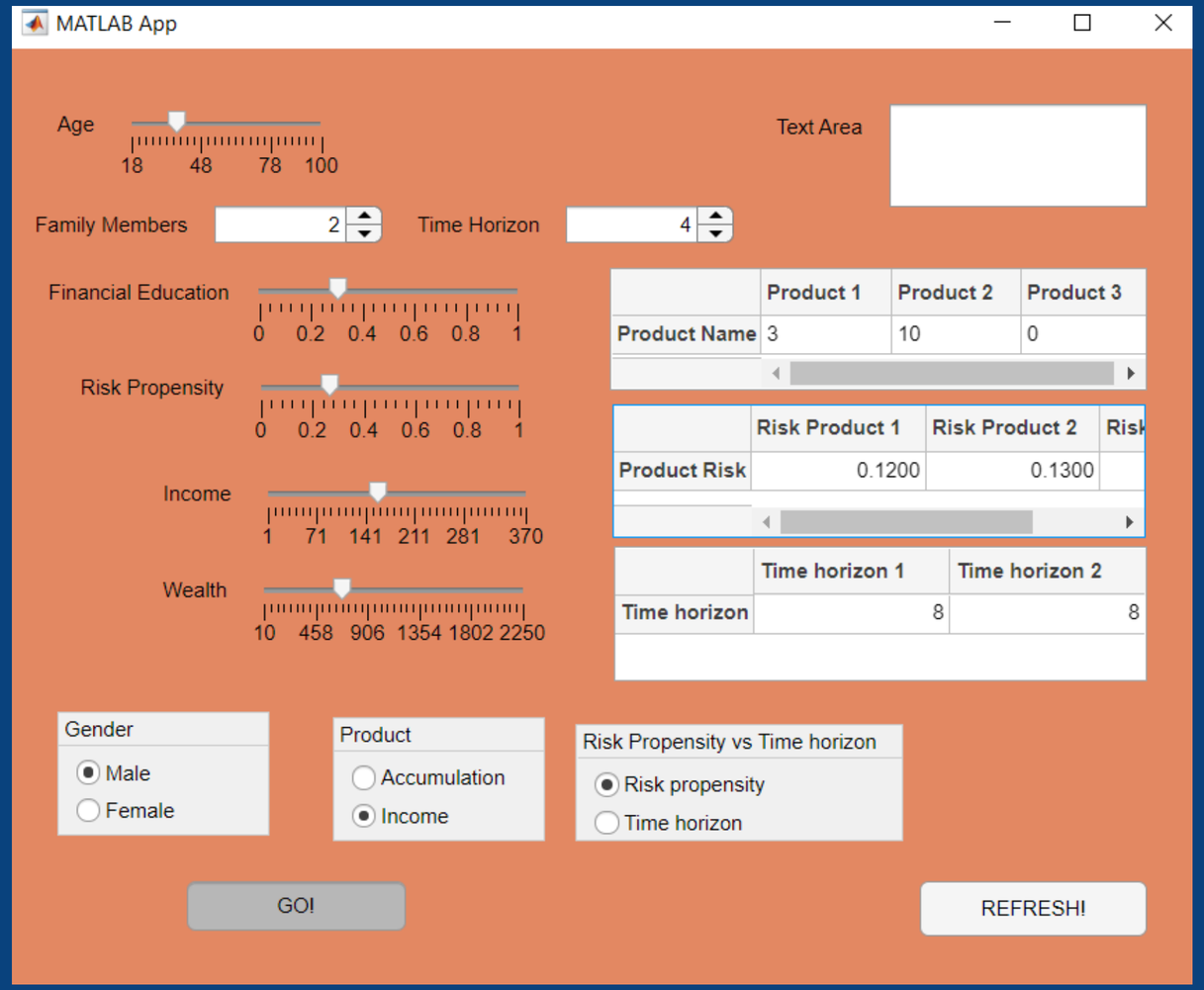
Example

Example of recommendation for a client with inputs as in the picture:

3 - Fixed Income Mutual Fund risk 0.12 time horizon 8y

10 - Fixed Income Segregated Account risk 0.13 time horizon 8y

Note that term deposits is not recommended even if the risk of the client in higher than the risk of this product: this is due to the fact that it is considered as alternative only if there are no suitable products of the original dataset.



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