

ACM-RECSYS'19 - 4TH HEALTH RECSYS WORKSHOP

EVOLUTIONARY APPROACH FOR 'HEALTHY BUNDLE' WELLBEING RECOMMENDATIONS

Hugo Alcaraz-Herrera

UNIVERSITY OF BRISTOL

H.ALCARAZHERRERA@BRISTOL.AC.UK

Iván Palomares

UNIVERSITY OF BRISTOL

THE ALAN TURING INSTITUTE

I.PALOMARES@BRISTOL.AC.UK

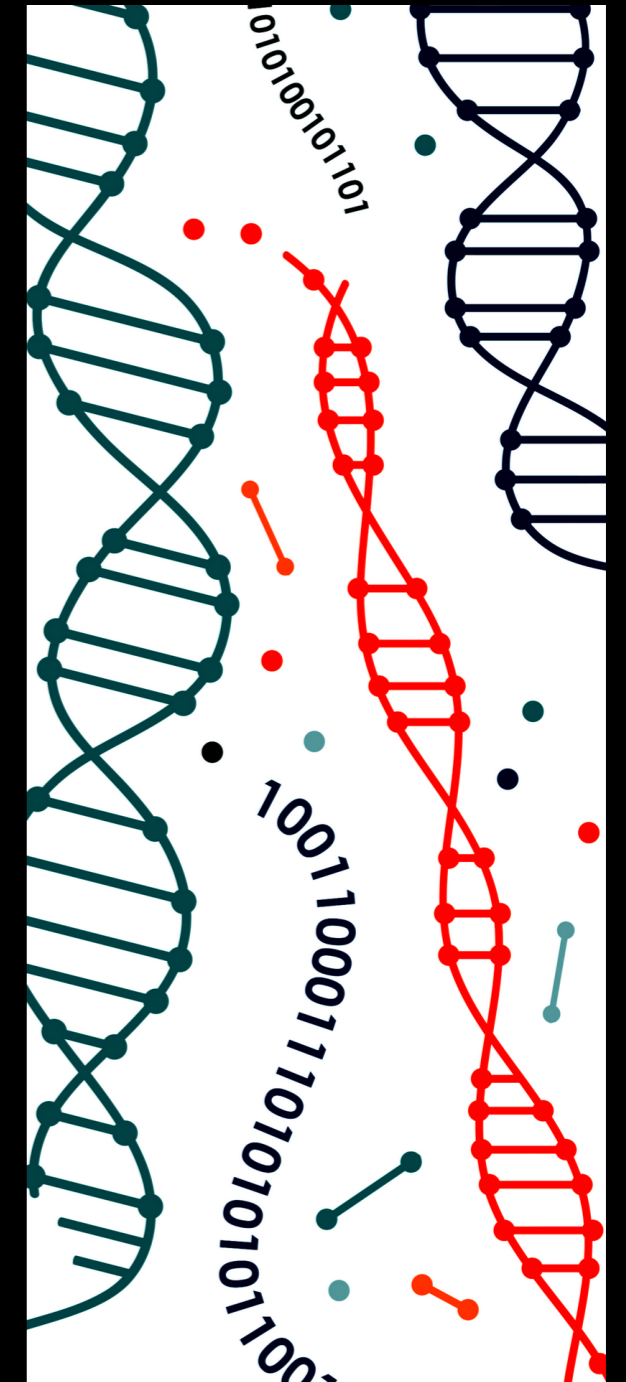
MOTIVATION

- Can we model the recommendation problem as a combinatorial optimization problem?
- Currently, there is not research bundling food and exercise recommendation as a unified recommendable item.
- As of yet, Genetic Algorithms (GA) are not fully exploited in Recommender Systems (RS) domain.

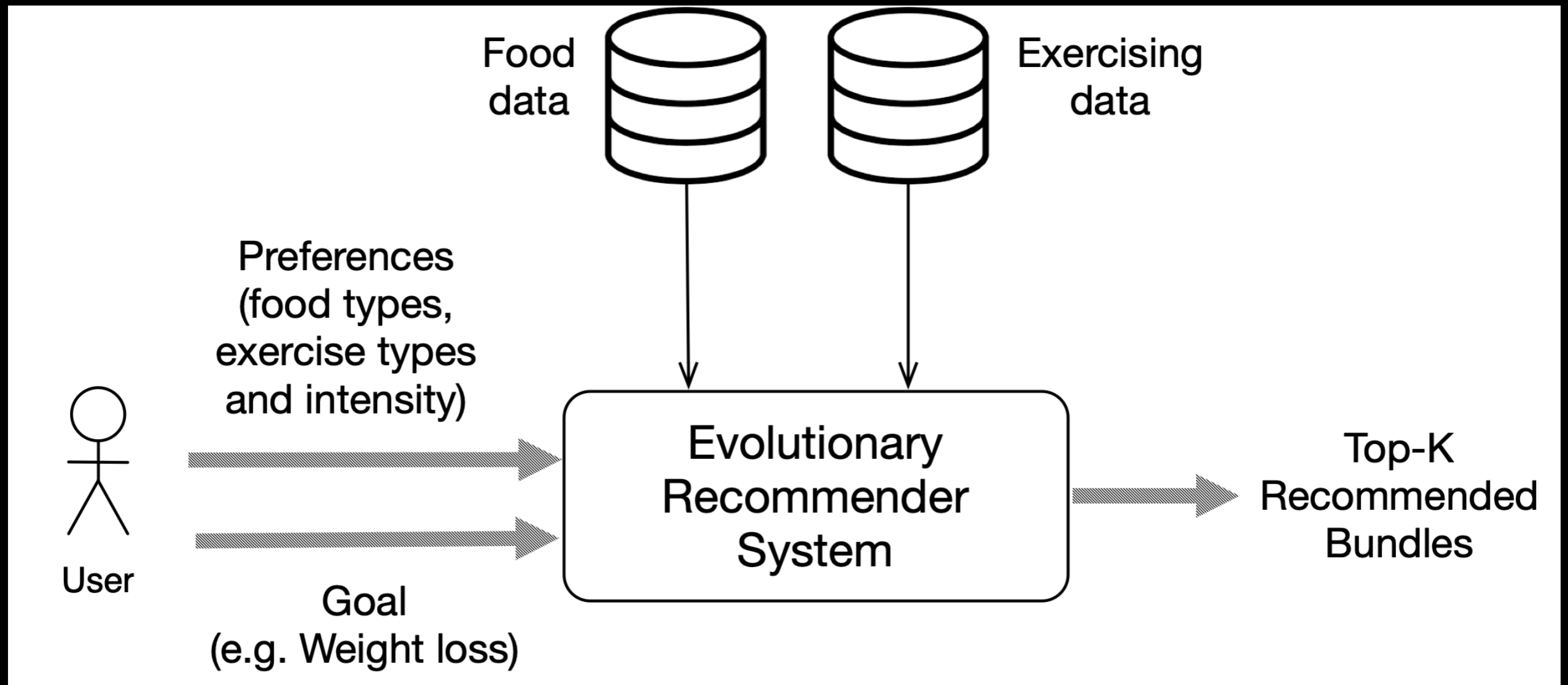


PROPOSAL

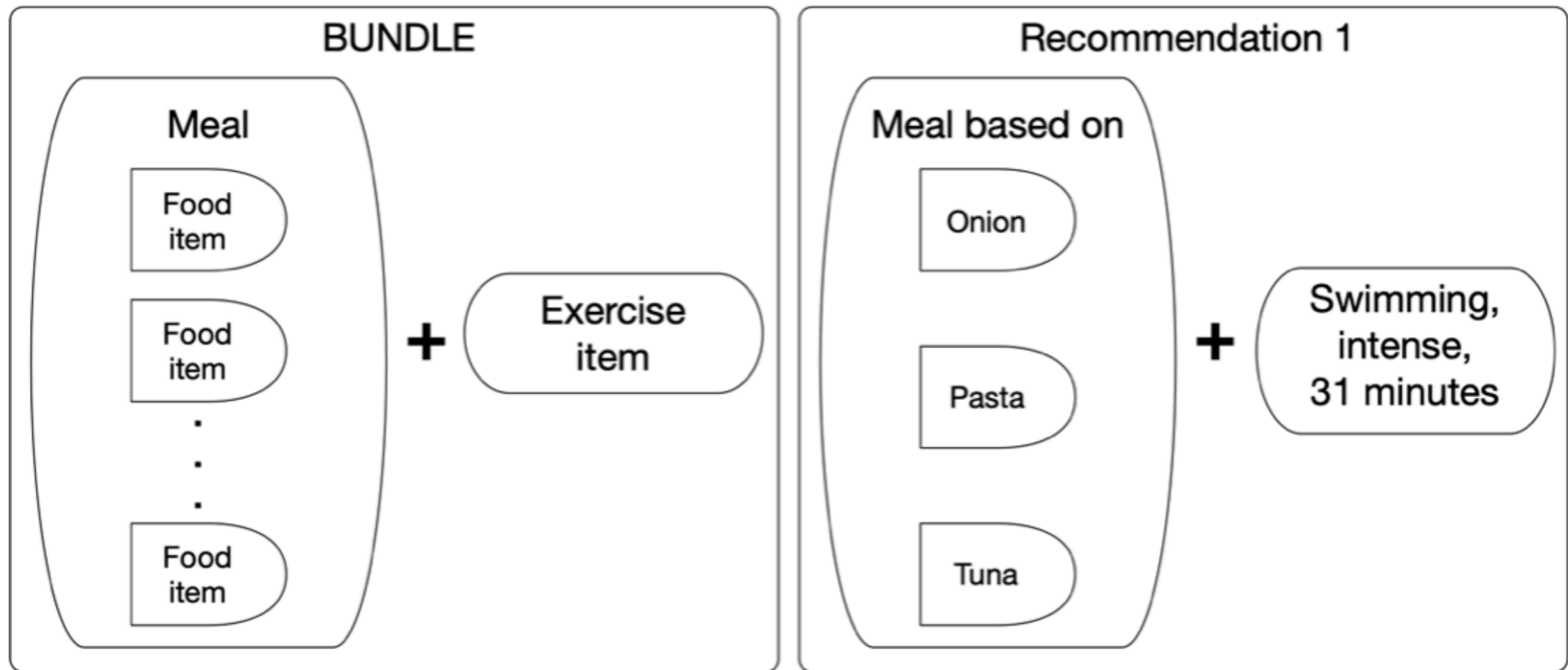
- A novel RS model based entirely on a GA, whose fitness function balances what the user likes (food and exercising) and her/his wellbeing goal.
- This RS model returns a “healthy bundle” that consists of a meal (set of food items) and an exercising activity.



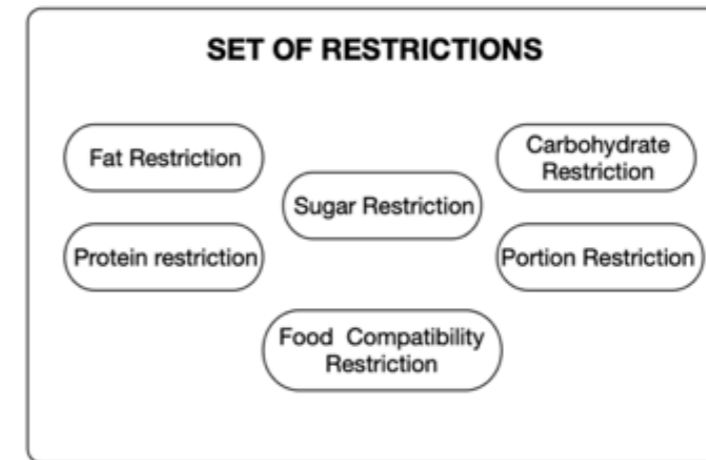
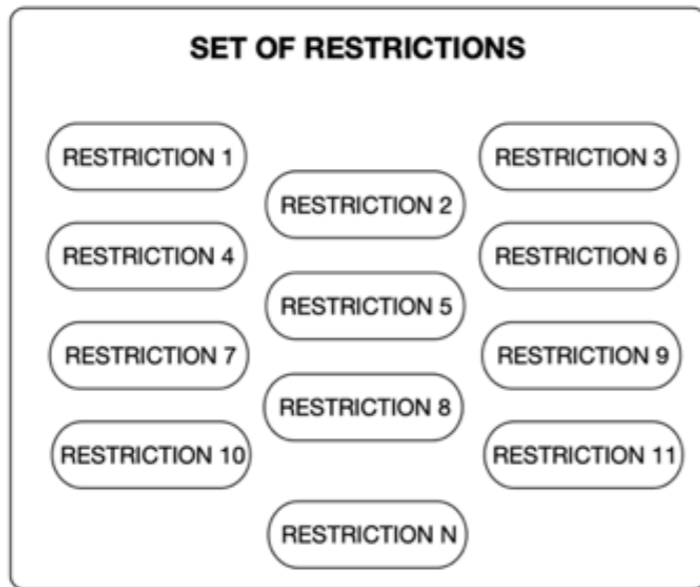
MODEL - ARCHITECTURE



MODEL - BUNDLE (ITEMS)



MODEL -FITNESS FUNCTION



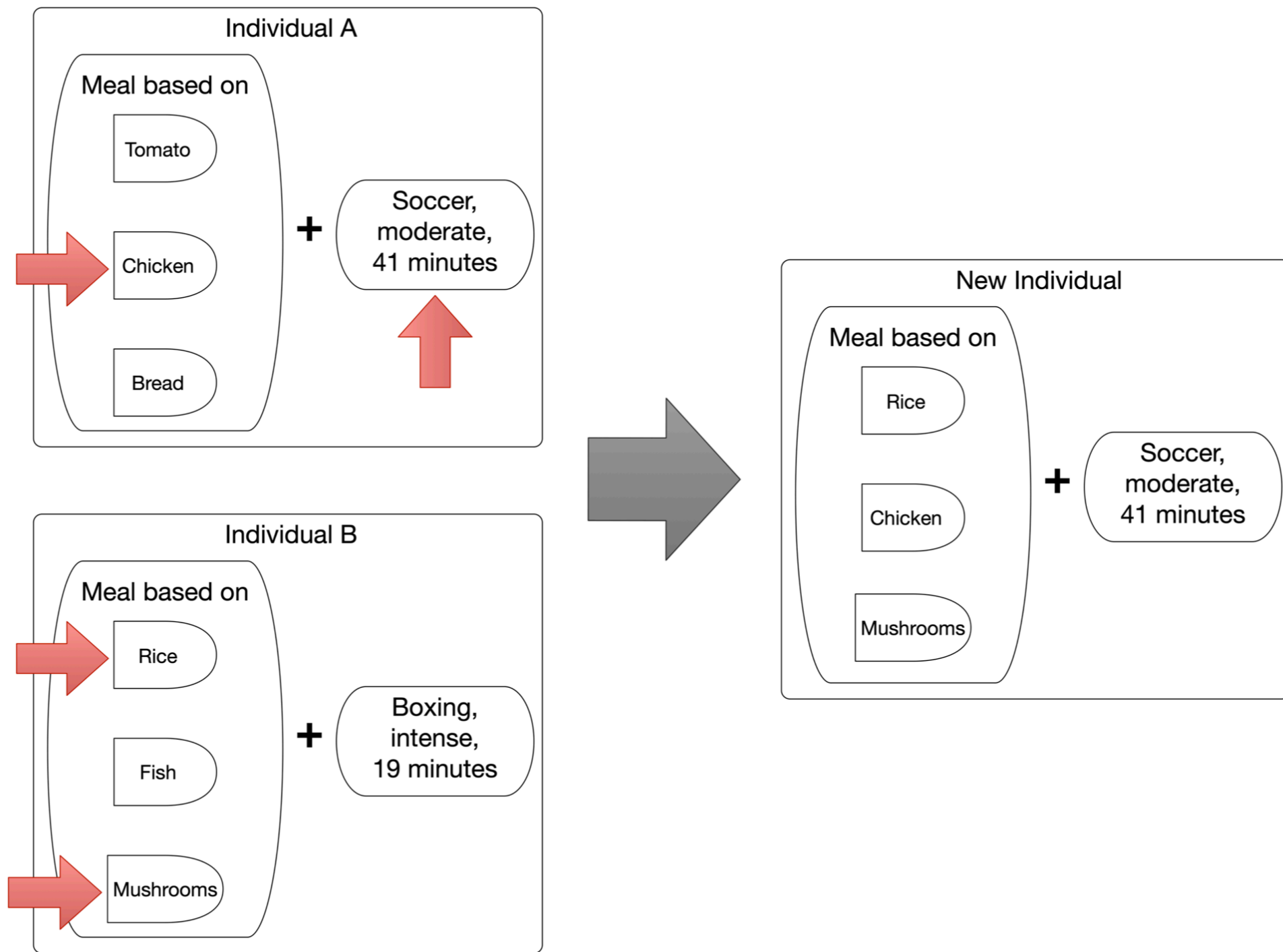
$$\text{Fitness Function}_1 = \text{Goal}_1 = \text{RESTRICTION 1} + \text{RESTRICTION 7} + \dots + \text{RESTRICTION N} + \text{User}_1 \text{ preferences}$$

$$\text{Fitness Function}_2 = \text{Goal}_2 = \text{RESTRICTION 5} + \text{RESTRICTION 11} + \dots + \text{RESTRICTION N} + \text{User}_2 \text{ preferences}$$

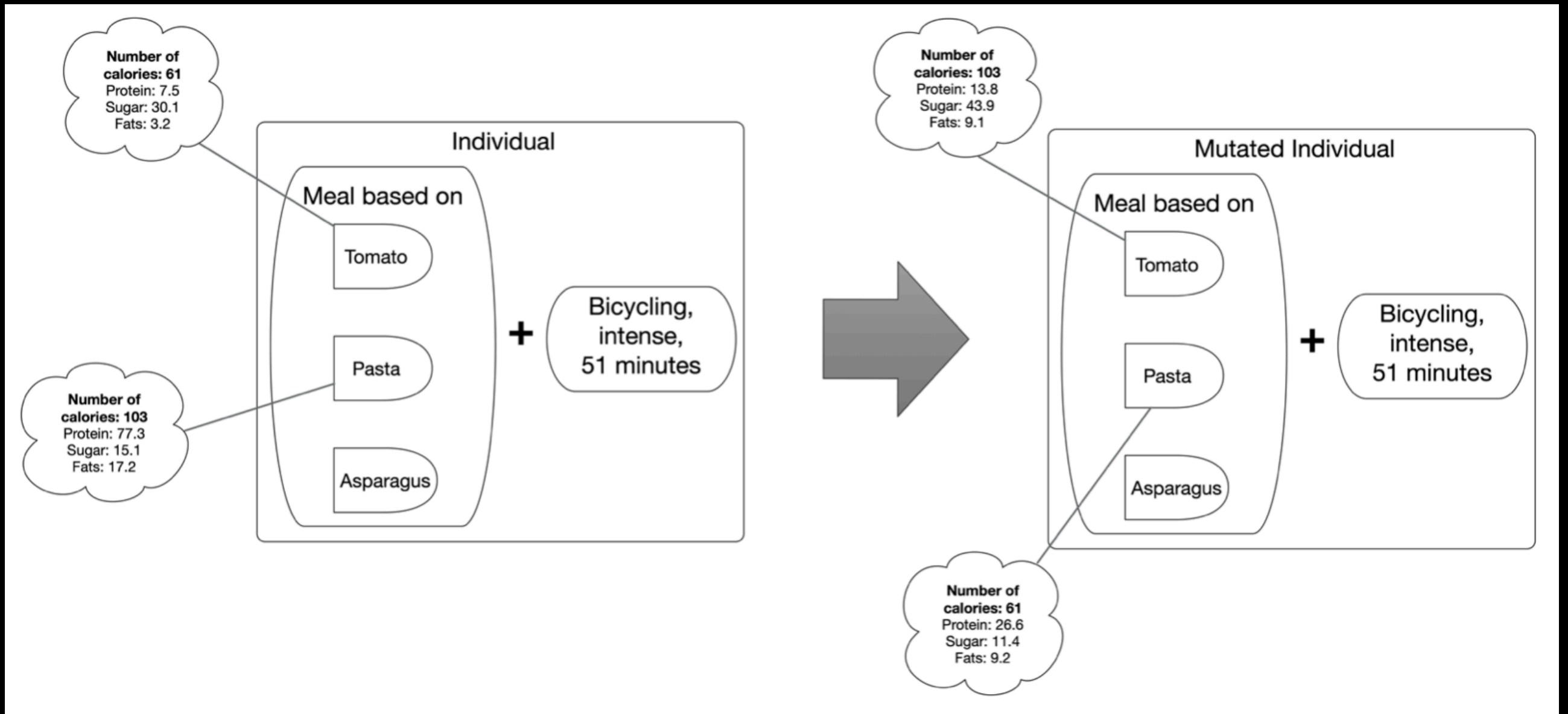
$$\text{Fitness Function}_N = \text{Goal}_N = \text{RESTRICTION 3} + \text{RESTRICTION 8} + \dots + \text{RESTRICTION N} + \text{User}_N \text{ preferences}$$

$$\text{Fitness Function}_1 = \text{Losing Weight} = \text{Fat Restriction} + \text{Sugar restriction} + \text{Food Compatibility Restriction} + \text{Portion Restriction} + \text{User preferences}$$

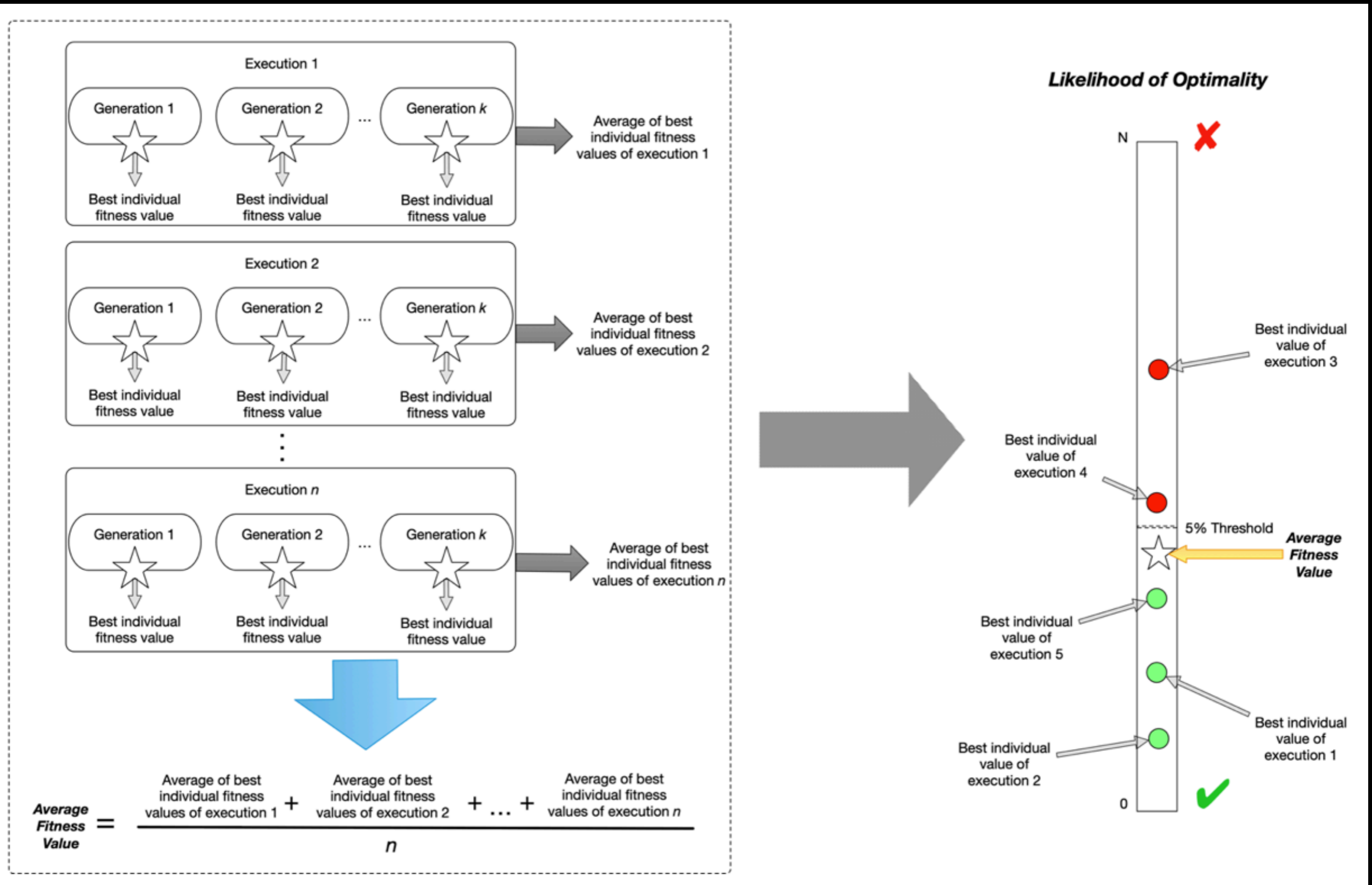
MODEL - GENETIC OPERATORS: CROSSOVER



MODEL - GENETIC OPERATORS: MUTATION



PERFORMANCE - METRICS



PERFORMANCE - RESULTS

- Number of executions: $n = 100$
- Number of generations: $k = 100$
- Number of individuals = 500

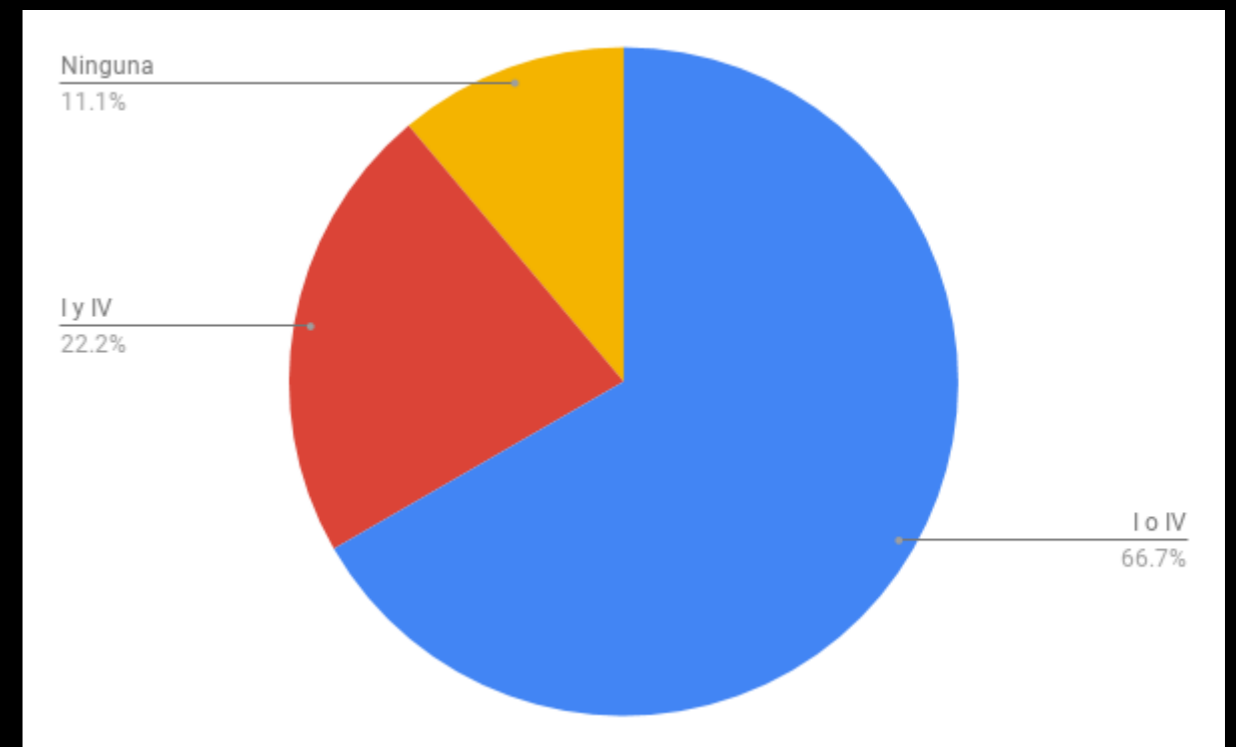
USER GOAL	AVERAGE FITNESS VALUE	LIKELIHOOD OF OPTIMALITY
LOSE WEIGHT	232.54	0.82
MAINTAIN WEIGHT	222.36	0.86
GAIN WEIGHT	3141.29	0.99
DIABETES CONTROL	1126.40	0.80
BUILD MUSCLE	121.13	0.64

ONLINE EVALUATION

A group of 54 volunteers were provided with a personalised lists of recommended bundles, two of them are "true" bundles generated by our model for her/him, whereas the other two are randomly picked items from a generic user with the same goal and neutral preference information.

ONLINE EVALUATION - RESULTS

- For an 88.9% of the volunteers, at least one of the two generated recommendations for them was picked.
- From these, 25% (12 persons) correctly guessed both of their recommendations.
- The vast majority of users has stated: "I like those meal-exercise bundles the most".



FUTURE WORK

- Introducing collaborative filtering to consider the preference and behaviour of similar users.
- Incorporating past user data from e.g. meal diaries and wearables to implicitly build their preferences.
- Considering other nutrients such as saturated fat, omega3-fatty acids, fibre, etc.
- Collaboration with nutritional domain experts for creating more precise recommendations.
- Considering user feedback for the generated recommendations.

THANKS FOR YOUR TIME!!!

