The metrics defined are as follows, for each metric it has been assumed to calculate the similarity between *u* and *a* users.

The parameters used:

- U → set of ratings given by the user *u*
- A → set of ratings given by the user *a*
- I_{ua} →set of items rated from both *u* and *a*
- $R_{u,i}$ →vote given by *u* to the i-th item
- $\overline{R_a}$ →average of the votes given by the user *a*

Defined metrics:

- Pearson:

$$PCC = sim(u,a) = \frac{\sum_{i \in I_{ua}}(R_{u,i}-\overline{R_u})(R_{a,i}-\overline{R_a})}{\sqrt{\sum_{i \in I_{ua}}(R_{u,i}-\overline{R_u})^2}\sqrt{\sum_{i \in I_{ua}}(R_{a,i}-\overline{R_a})^2}} = \frac{COV(u,a)}{\sigma_u\, \sigma_a}$$

- *Pearson Seed Exploration Factor (PSEF):*

$$PSEF(u,a) = \frac{\sum_{i \in I_{ua}}(R_{u,i}-\overline{R_u})(R_{a,i}-\overline{R_a})}{\sqrt{\sum_{i \in U}(R_{u,i}-\overline{R_u})^2}\sqrt{\sum_{i \in A}(R_{a,i}-\overline{R_a})^2}}$$

- *Pearson Factor Simmetric Similarity (PFSS):*

$$PFSS(u,a) = \frac{\sum_{i \in I_{ua}}(R_{u,i}-\overline{R_u})(R_{a,i}-\overline{R_a})}{\sqrt{\sum_{i \in U}(R_{u,i}-\overline{R_u})^2}\sqrt{\sum_{i \in A}(R_{a,i}-\overline{R_a})^2}} * \frac{|U(u) \cup U(a)|}{|U(u) \cap U(a)|}$$

- *Pearson Factor Asymmetic Similarity (PFAS):*

$$PFAS(u,a) = \frac{\sum_{i \in I_{ua}}(R_{u,i}-\overline{R_u})(R_{a,i}-\overline{R_a})}{\sqrt{\sum_{i \in U}(R_{u,i}-\overline{R_u})^2}\sqrt{\sum_{i \in A}(R_{a,i}-\overline{R_a})^2}} * \frac{|U(u) \cap U(a)|}{|U(u)|} * \frac{2|U(u) \cap U(a)|}{|U(u)|+|U(a)|}$$

- *Pearson Side Asymmetric Similarity (PSAS)*:

$$PSAS(u,a) = \frac{\sum_{i \in I_{ua}}(R_{a,i}-\overline{R_a})^2}{\sqrt{\sum_{i \in U}(R_{u,i}-\overline{R_u})^2}\sqrt{\sum_{i \in A}(R_{a,i}-\overline{R_a})^2}}$$

- *Pearson Asymmetric Dissimilarity (PAD)*:

$$PAD(u,a) = \frac{\sum_{i \in A}(R_{a,i} - \overline{R_a})^2 \; - \; \sum_{i \in I_{ua}}(R_{u,i} - \overline{R_u})\,(R_{a,i} - \overline{R_a})}{\sqrt{\sum_{i \in U}(R_{u,i} - \overline{R_u})^2}\;\sqrt{\sum_{i \in A}(R_{a,i} - \overline{R_a})^2}}$$

- *Additive Adjusted Pearson Seed Factor (AAPF)*:

  $AAPF(u,a) = PCC(u,a) - \lambda \cdot PSEF(u,a)$

- *Additive Adjusted Pearson Factor Symmetric Similarity (AAPS):*

  $AAPS(u,a) = PCC(u,a) - \lambda \cdot PFSS(u,a)$

- *Additive Adjusted Pearson Factor Asymmetric Similarity (AAPA):*

  $AAPA(u,a) = PCC(u,a) - \lambda \cdot PFAS(u,a)$

- *Additive Adjusted Pearson Side Asymmetric Similarity (AAPSA):*

  $AAPSA(u,a) = PCC(u,a) - \lambda \cdot PSAS(u,a)$

- *Additive Adjusted Pearson Asymmetric Dissimilarity (AAPAD):*

  $AAPAD(u,a) = PCC(u,a) - \lambda \cdot PAD(u,a)$

- *Multiplicative Adjusted Pearson Seed Factor (MAPF)*:

  $$MAPF(u,a) = \frac{PCC(u,a)}{PSEF(u,a)}$$

- *Multiplicative Adjusted Pearson Factor Symmetric Similarity (MAPS):*

  $$MAPS(u,a) = \frac{PCC(u,a)}{PFSS(u,a)}$$

- *Multiplicative Adjusted Pearson Factor Asymmetric Similarity (MAPA):*

$$MAPA(u,a) = \frac{PCC(u,a)}{PFAS(u,a)}$$

- *Multiplicative Adjusted Pearson Side Asymmetric Similarity (MAPSA):*

$$MAPSA(u,a) = \frac{PCC(u,a)}{PSAS(u,a)}$$

- *Multiplicative Adjusted Pearson Asymmetric Dissimilarity (MAPAD):*

$$MAPAD(u,a) = \frac{PCC(u,a)}{PAD(u,a)}$$

For each recall of each formula within the "user_user.py" file you must use the acronym:

- *Pearson : pcc*
- *Pearson Seed Exploration Factor : psef*
- *…*
- *Multiplicative Adjusted Pearson Asymmetric Dissimilarity : mapad*

For additive schemes, i.e. those beginning with "Additive", it is necessary to set also the λ parameter, which must be valid between 0.1 and 1, at intervals of 0.1.