Multi Criteria Decision Aid

Practical Work

Ranking Yoga Âsana with Electre III

Olga Valls Murcia

Introduction

When a Yoga teacher prepares a session for his practitioners, takes into account their physical skills, at least in the firsts sessions, so that they can adapt to the different âsana (positions) that can be done and prepare their bodies so that they can follow through more complex ones.

Each âsana belongs to one or more types, as when one performs it, it affects different parts of the body. The âsana also has psychological effects, which we are not dealing with in this work.

Given the different groups of âsana described below, the following order (with some exceptions) should be followed so that the energy in the body flows properly and prepares it for the final meditation:

- Stretch
- Strength
- Extension
- Torsion
- Balance
- Bending
- Inversion
- Meditation

The idea for this Practical Work is to feed the system with 40 different âsana, 5 per each group described, and let the system rank this alternatives for a new practitioner with no expertise in Yoga, who wants to taste a session.

The system will show all the alternatives ranked, then is the Yoga teacher the one that will have to choose the 5 or 6 âsana he will finally use to create the session respecting the ranking and the group order specified.

The criteria for the alternatives are the following:

- Difficulty
- Intensity
- Knees
- Legs
- Pelvis
- Back
- Abdominals
- Shoulders
- Arms

Software

The MCDA method used is **ELECTRE III**, where the system can provide a **Ranking** of the alternatives via distillation.

ELECTRE III concerns ranking problems involving quasi and/or pseudo criteria (two thresholds), based upon a valued outranking relation.
It uses two discrimination thresholds to be more flexible in the comparisons of alternatives.
For each criterion, there exists:

- Indifference threshold: maximum difference on performance considered indifferent (equally preferred).
- Preference threshold: a difference larger than it shows a clear strict preference in favour of one of the options.

This makes possible a valued concordance and discordances indexes (instead of Boolean as in true-criteria).

There is a third threshold, veto, so that if there is a difference larger than the veto in favour of b respect to a, that will require the negation of the outranking relation aSb.

With this, given the performance matrix, the criteria, the weights and the alternatives, the concordance and discordance matrices can be computed, along with the credibility matrices.

For obtaining the ranking, ELECTRE proposes one alternative using ELECTRE II, Net Flow Scores, and another one using ELECTRE III, distillation, the one used for this work.
The distillation process is part of the Exploitation step, where the user can choose between selection, ranking and sorting. That procedure is applied, as previously said, to the credibility matrix.

There is two distillation processes:

- Downward distillation: a ranking from the best qualification to the worst is done.
- Upward distillation: a ranking from the worst qualification to the best is done.

And finally a final ranking is made combining both orders.

The **workflow** of this process is shown in Figure 1:

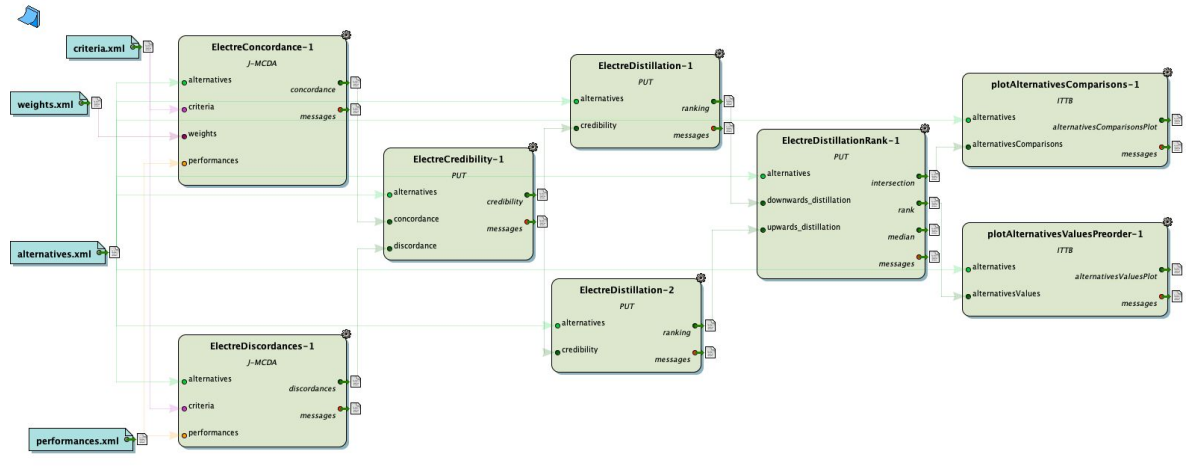


Figure 1: Workflow in Electre III of the Yoga âsana ranking

Input data

The **inputs** for this process are the following XMLs:

- alternatives.xml: 40 differents alternatives; 5 âsana per group.

- criteria.xml: 9 different criteria: difficulty, intensity and 7 parts of the body that are worked with the âsana.

    - preferenceDirection: the idea is to minimize all the criteria for the new practitioner except for the pelvis, back and abdominals that will be maximized, as there are the parts of the body where the tensions are stored and it is important to work them.

    - thresholds:
        - indiference: all set at 1 except for the abdominals, which is set at 2.

        - preference: all set at 2 except for the abdominals, which is set at 3.

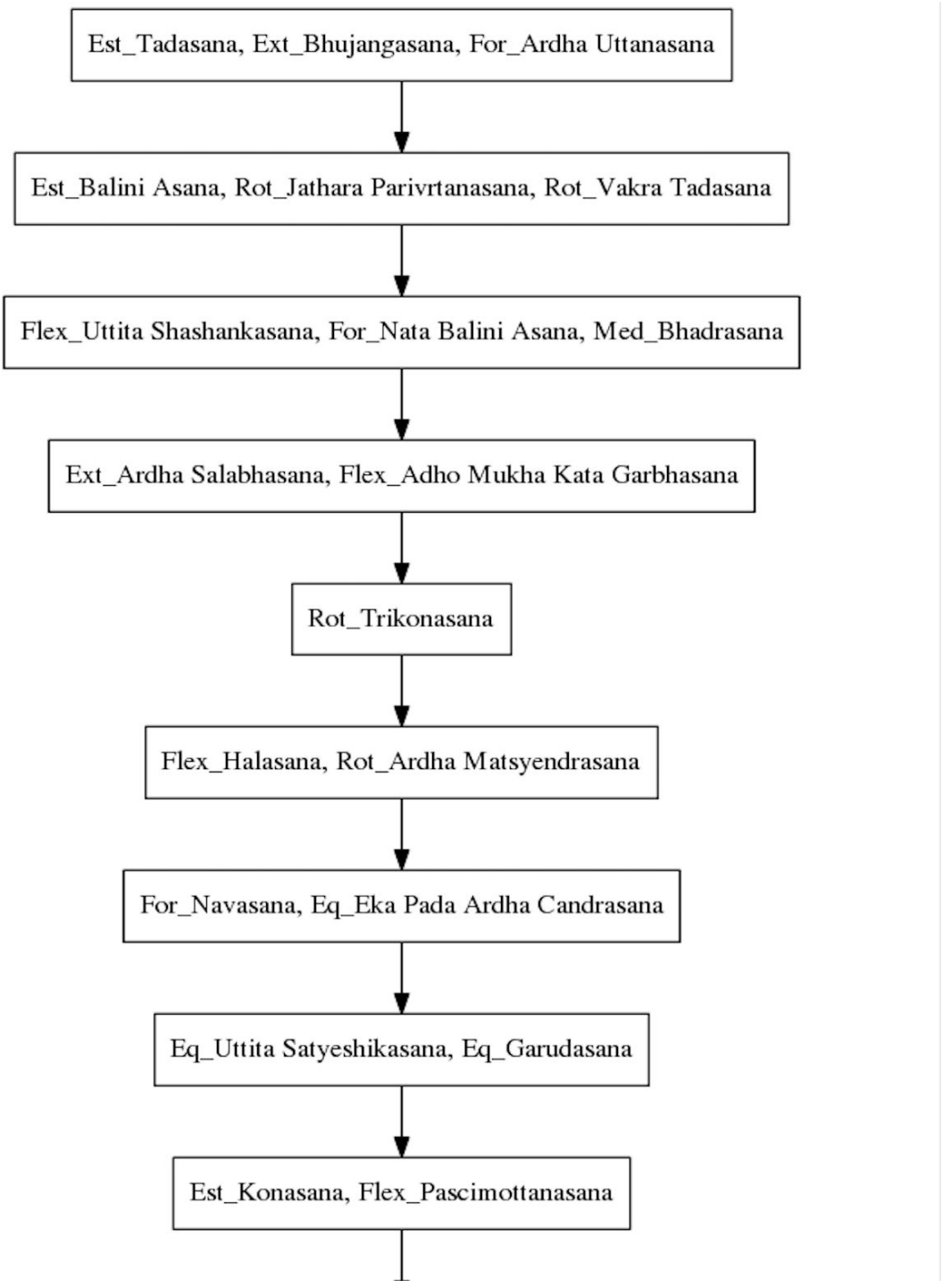
        - veto: only applied to difficulty and intensity with score 4. If an âsana is better than another but for difficulty or intensity is 4 points harder that the other, the first one is not better anymore.

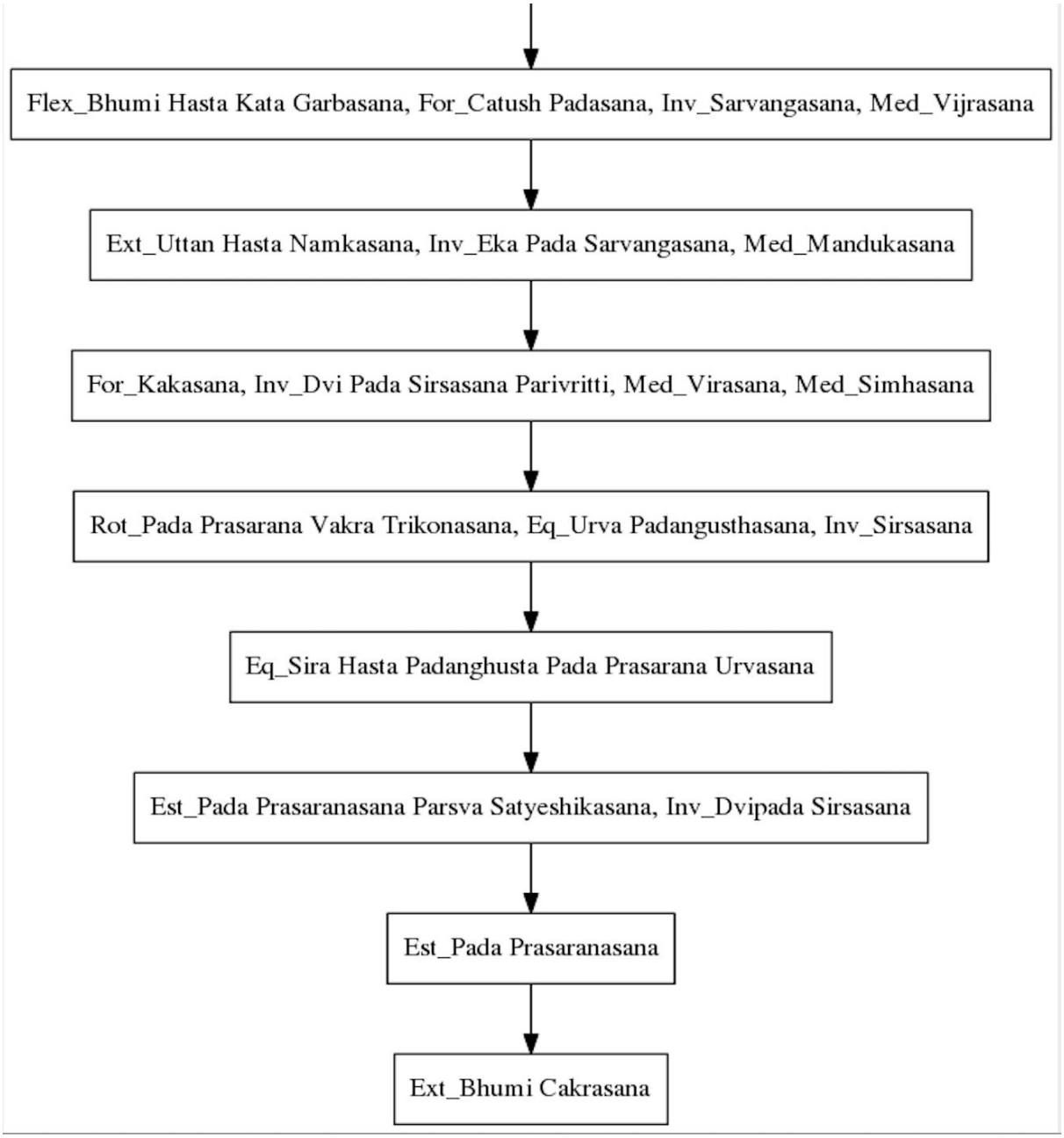
- weights.xml: Difficulty, intensity and pelvis are scored 0.2. Back and abdominals are scored 0.1. Knees, legs, shoulders and arms are scored 0.05. Total sum is 1.

- performance.xml: Each âsana is scored from 1 to 10 for each of the criteria defined, where 1 is easy or few work of that part of the body, and 10 is difficult or hard work for that part of the body.

Results

The final Ranking obtained with Electre III is the following, where for some positions, more than one âsana share the same priority:





Now would be the time for the Yoga teacher to pick one from each group to construct the âsana session for the Yoga class.

One example taken from the result could be:

Tadâsana
Ardha Uttanâsana
Bhujangâsana
Jathara Parivrtanâsana
Eka Pâda Ardha Candrâsana
Uttita Shashankâsana
Sarvangâsana
Bhadrâsana

Conclusions

Depending on the kind of problem at hand, a different MCDA method can be applied. The alternatives, weights and criteria always play a role in all methods, while thresholds (indifference, preference and veto) are applied only on some of them, like ELECTRE III.

Git Repository

In https://github.com/ovalls/mai_pmcdss you can find the code for the Diviz workflow, along with the XMLs, performance matrix, intermediate matrices, and results.

- `PracticalWork_OlgaValls.dvz`: diviz workflow.
- `PracticalWork_OlgaValls.png`: PMG of the Diviz workflow.
- `PerformanceMatrix.pdf`: Performance Matrix: alternatives vs criteria.
- `PracticalWork_OlgaValls.pdf:` this report.
- `xmls/alternatives.xml`: alternatives.
- `xmls/criteria.xml`: criteria.
- `xmls/performances.xml`: performances.
- `xmls/weights.xml`: weights.
- `results/1_concordance_matrix.html`: Concordance matrix.
- `results/2_discordance_matrix.html`: Discordance matrix.
- `results/3_credibility_matrix.html`: Credibility matrix.
- `results/4_distillation_downwards.html`: Results after distillation downwards.
- `results/5_distillation_upwards.html`: Results after distillation upwards.
- `results/6_distillation ranking.html`: Results after both distillations.
- `results/7_Ranking_with_distillation.html`: Final results.
- `results/8_Ranking_with_distillation.png`: PNG of final result.