co-rank: An Online Tool for Collectively Deciding Efficient Rankings Among Peers

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The rationale of co-rank

- The co-rank tool is designed to facilitate the grading process in Massive Open Online Courses (MOOCs).
- Goal: implement an efficient grading system to evaluate the performance of the students.
- Problem: the number of students attending a course is huge, while the number of available professional graders is limited.
- Suggestion: peer grading; each student acts as a grader as well and is responsible of assessing a small number of other exam papers.
- The co-rank tool implements *ordinal* peer grading-like techniques.

Aggregation Methods

- co-rank supports three aggregation methods motivated by social choice theory; the function of all of them is similar.
- Every exam paper is assigned points according to the position it has in the partial rankings it participates.
- The score of an exam paper equals the total pointed assigned to it.
- By sorting the exam papers in decreasing order of their score, a global ranking of them is computed..
- Ties are resolved randomly.

Borda count:
- It is characterized by the scoring vector $(k, k-1, ..., 1)$.
- The exam paper in the first position of a partial ranking is assigned k points, the exam paper in the second position is assigned $k-1$ points, and so on.

Partition:
- Every student approves exactly $k/2$ exam papers.
- Only the exam papers that have been approved are assigned a point each.

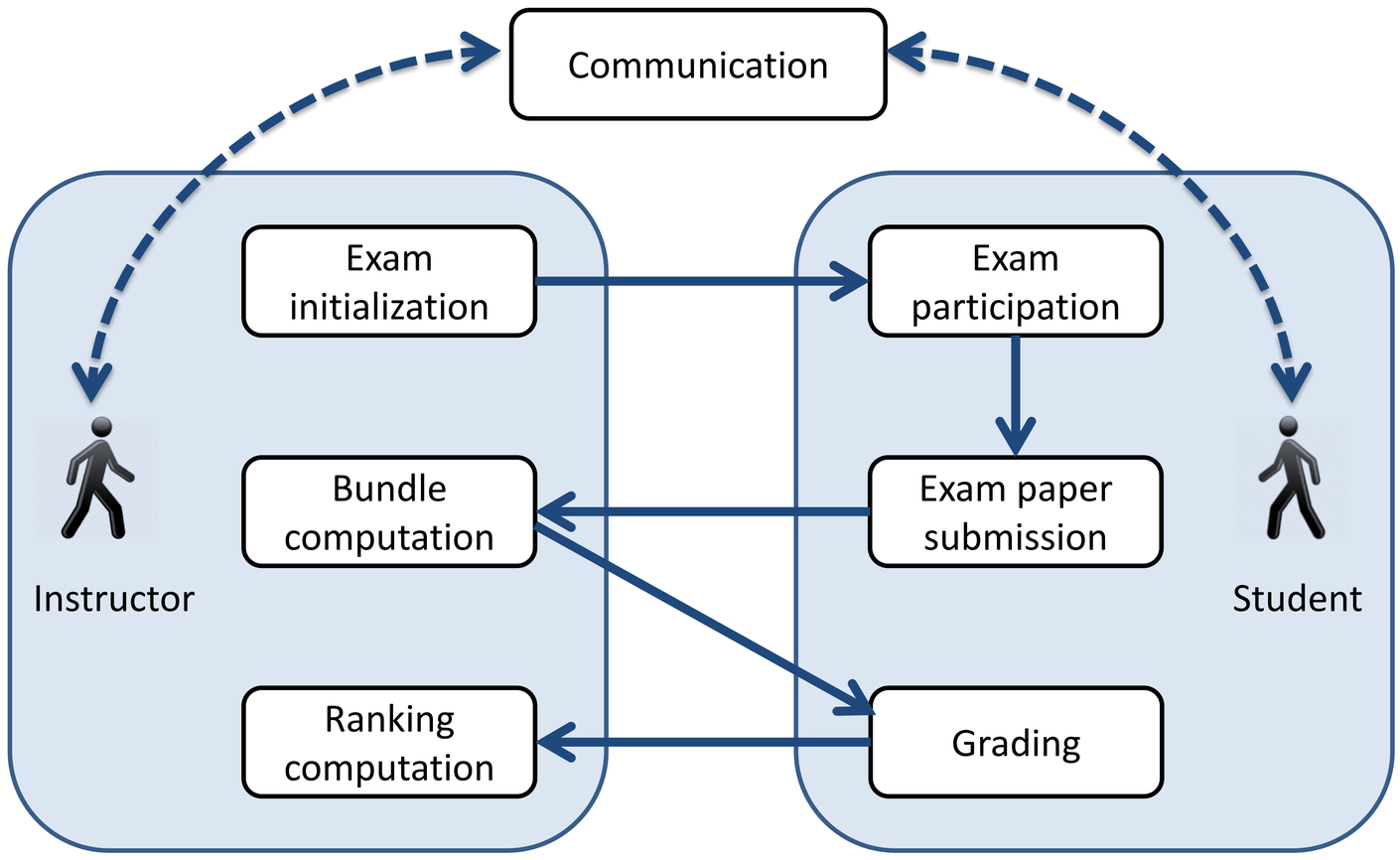
Randomized approval:
- Every student approves a random number of exam papers, selected uniformly at random from the set $\{1, ..., k-1\}$.
- Again, only the exam papers that have been approved are assigned a point each.

Technologies used

CSS HTML JS Bootstrap php MySQL

Functionalities – System workflow

Initialization phase:
- The instructor creates a new exam;
- She uploads a file containing the exam questions
- She defines the submission and grading deadlines;
- She defines communication rules among students and instructor – (uni/bi)directional;
- She defines the aggregation method.



Examination phase:
- Every student downloads the exam question;
- She answers them and uploads a file containing her answers.

Grading phase (after the submission deadline):
- The instructor manually initiates the grading process;
- A bundle computation algorithm computes a set of bundles of exam papers;
- Every student is assigned a bundle (not containing her exam paper);
- Through the user-friendly interface of co-rank tool, each student orders the exam papers in her bundle;
- After the grading deadline, the instructor initiates the aggregation of the partial rankings;
- A global ranking of the students is computed and announced.

Bundle computation

Properties:
- Every exam paper must be contained in exactly k bundles;
- Every student must be assigned a bundle not containing her own exam paper.

The Algorithm:
- Select $k+1$ pairwise disjoint perfect matchings on the complete bipartite graph $K_{n,n} = (U, V, E)$.
- This creates n sets of $k+1$ elements;
- Every set defines a student and the k exam papers she has to grade.

Computation of a perfect matching:
- For each node $u \in U$, select uniformly at random an edge among its incident ones, remove it and continue for the remaining nodes;
- If u does not have any incident edges, then restart the matching computation from scratch.

Demo

- Create a new account with the role of instructor and a new account with the role of a student.
- Create a new exam with 10,000 students.
- Present the functionalities provided by the co-rank tool in both cases through a step-by-step scenario.

co-rank website

The co-rank tool can be accessed through the url:

co-rank.ceid.upatras.gr

More info (theory)

Ioannis Caragiannis, George A. Krimpas, and Alexandros A. Voudouris, Aggregating partial rankings with applications to peer grading in massive online open courses. AAMAS 2015, pp. 675–683.