

# Sportconstraint Learning using Tensor Data



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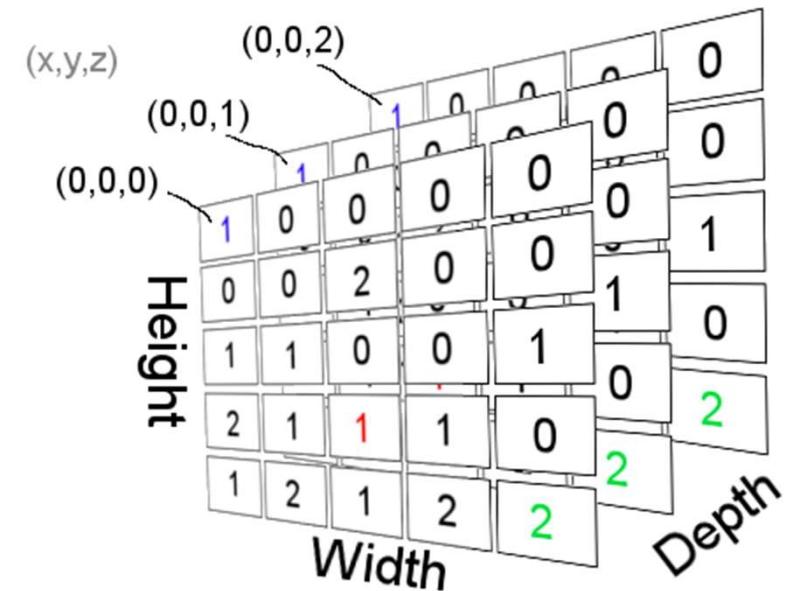
# Context

- Many real world problems require constraints
- Sport scheduling is really complex and laboursome
  - 2 leagues
  - Each league consists of 3 divisions
  - 162 games per team per regular season
- Could this be automated to lower the amount of work?



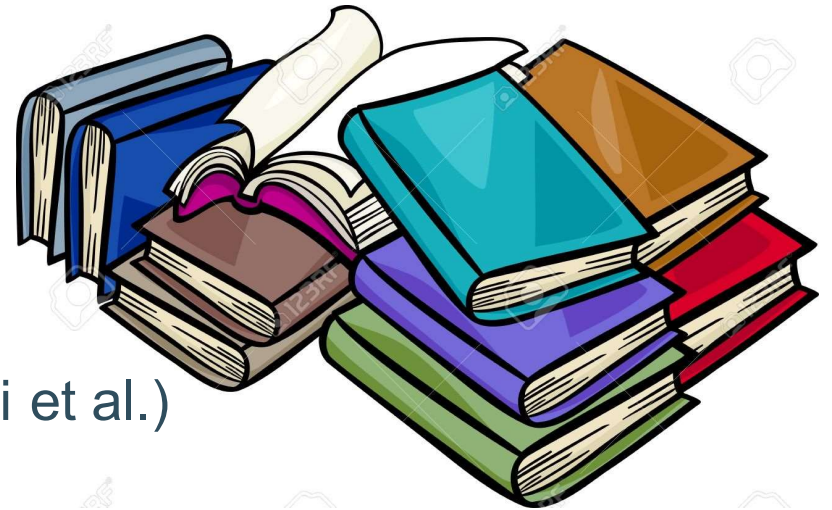
# Aim

- Constraint programming to make scheduling easier
  - Learning/acquiring constraints using tensor manipulation
  - Make schedule problems easier
    - Particular interest in sports!



# Approach: Literature study

- Different kinds sport schedules? Terminology?
  - X-Round Robin
- Cost functions
- Sport scheduling hard / soft constraints?(Nurmi et al.)
- Previous work on sport scheduling?
  - Traveling tournament problem
  - Modelseeker



## Approach: Research Questions

- What could we learn from using CountOR as is?
- Could we adapt/generalize CountOR to CountSPORT to learn scheduling constraints?
  - To what extent can we acquire all constraints?
- Could we integrate minimizing/maximizing cost functions into CountSPORT?

GROUP E			
1  BRAZIL		MATCH 9 ROSTOV 17.06 21:00	MATCH 25 SAINT PET. 22.06 15:00
2  SWITZERLAN.	MATCH 9 ROSTOV 17.06 21:00		MATCH 41 MOSCOW SP. 27.06 21:00
3  COSTA RICA	MATCH 25 SAINT PET. 22.06 15:00	MATCH 42 NOVGOROD 27.06 21:00	MATCH 26 KALININER 22.06 20:00
4  SERBIA	MATCH 41 MOSCOW SP. 27.06 21:00	MATCH 26 KALININER 22.06 20:00	MATCH 10 SAMARA 17.06 15:00



The diagram shows three 3x3 matrices,  $A_1$ ,  $A_2$ , and  $A_3$ , arranged horizontally. Dotted lines connect corresponding elements across the matrices, illustrating the element-wise addition process to form matrix  $A$ .

Matrix  $A_1$  (left):

1	0	0
1	0	0
0	0	0

Matrix  $A_2$  (middle):

0	0	0
0	1	0
0	0	0

Matrix  $A_3$  (right):

0	0	0
0	0	0
0	0	1

# Practical approach: CountOR(benchmark)

- Generate set of schedules using own constraints
  - D
  - D
  - D
- Learn with CountOR as is
  - Generate new set schedules using acquired constraints
  - Satisfy?

# Practical approach: CountSPORT

- Adapt CountOR
  - Hard constraints
  - Soft constraints?



# Putting it to work: a practical use case

- Scheduling the Belgium football competition (format used since 2009)
  - 16 teams: 30 games in regular competition
  - Playoff 1: Division of 6 teams
  - Playoff 2: 2 divisions of 4 teams
  - Playoff 3: 1 division of 2 teams
- Lots of edge cases

