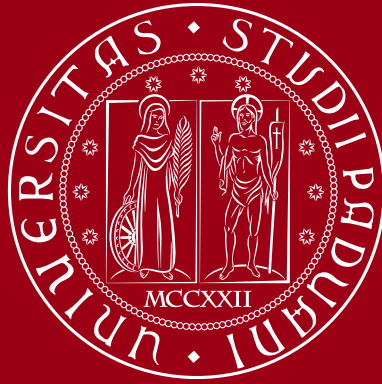


1222 · 2022  
**800**  
ANNI



UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA



# Matching models for evacuation and allocation of people in case of disasters and wars

*Simone Bastasin, Simone Bortolin, Thomas Trevisan*



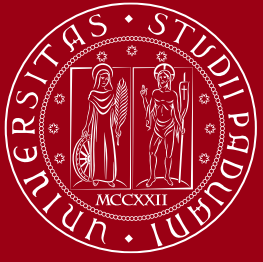
UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

# Introduction



- Increasing number of wars and terrorist attacks
- Pilot project for an assignment process for refugee resettlement
- Use artificial intelligence to generate a model for building evacuations





# Matching models

Matching model for refugee resettlement

- 6-tuple  $(C, R, q, P_c, P_r, F)$

- $C = \{c_1, \dots, c_m\}$  countries
- $R = \{r_1, \dots, r_n\}$  refugees
- $q = \{q_i, \dots, q_m\}$
- $P_c = \{P(c_1), \dots, P(c_m)\}$
- $P_r = \{P(r_1), \dots, P(r_n)\}$
- $F = \{F(f_1), \dots, F(f_l)\}$
- $n \gg m$

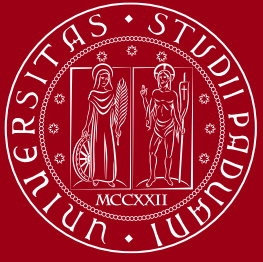
Matching model in case of disaster

- 6-tuple  $(E, P, q, N_e, N_p, F)$

- $E = \{e_1, \dots, e_m\}$  exits
- $P = \{p_1, \dots, p_n\}$  people
- $q = \{q_i, \dots, q_m\}$
- $N_e = \{N(e_1), \dots, N(e_m)\}$
- $N_p = \{N(p_1), \dots, N(p_n)\}$
- $F = \{F(f_1), \dots, F(f_l)\}$
- $n \gg m$

Very similar!!

one model  
simplifies  
things

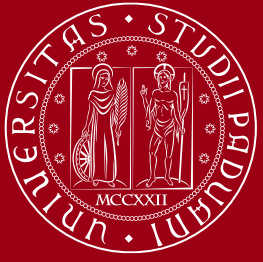


UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

# Matching models in case of war



Case	Model used	Matching pairs	Quote limit	Application description
<i>Mass escapes</i>	<b>Refugee resettlement</b>	People - Countries	Country quote	<b>Redistribution</b> of people to safe countries
<i>War attacks</i>	<b>In case of disaster</b>	People - Exits	Exit quote	<b>Evacuation</b> of people from buildings at risk
<i>War attacks</i>	<b>In case of disaster</b>	People - Bunkers	Bunker quote	<b>Shelter</b> of people towards bunkers



Matching models as College Admissions Problem and School Choice Problem

- College Admissions Problem:

$(C, R, q, P)$

- $P = \{P_c, P_r\}$
- Not admissible for COM

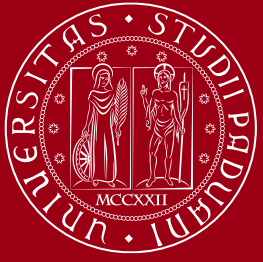
- School Choice Problem:

$(C, R, P_r, Pri)$

- $Pri = \{P_c\}$
- Admissible

Machine learning-based Matching

- Use machine learning algorithm to generate a  $\pi$  from  $P_c$
- CRSD:  $(F, C, q, \pi, P, \gamma)$
- CRV:  $(F, C, q, \pi, v, \gamma)$
- The machine learning model  $\pi$  is **Admissible** for **COM** because the algorithm used, even if it calculates a wrong value, doesn't cause any death.



UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

# Conclusions

 DIPARTIMENTO  
DI INGEGNERIA  
DELL'INFORMAZIONE

- The use of stable matching models like the ones just proposed can help people life a lot:
  - Possibility to realize a general model adaptable to more emergency situations
  - Combine efforts to improve a single model that can be reused for many purposes

