THE EUROPEAN AI WEEK
MARCH 27-31 2023 BRUSSELS

AI WEB 3 CYBER DATA E-SKILLS

Pushing AI out of the Lab

with on-the-fly mixture domain adaptation

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We dream of *trustable* systems

- All ML/AI systems have some uncertainty.
- In order to *trust* the systems based on ML/AI, we want to know their uncertainties !
- Systems performing classifications can output probabilities called *posteriors*.

I need to compute the probabilities of the various possible decisions (hypotheses) given my observations (evidence) !

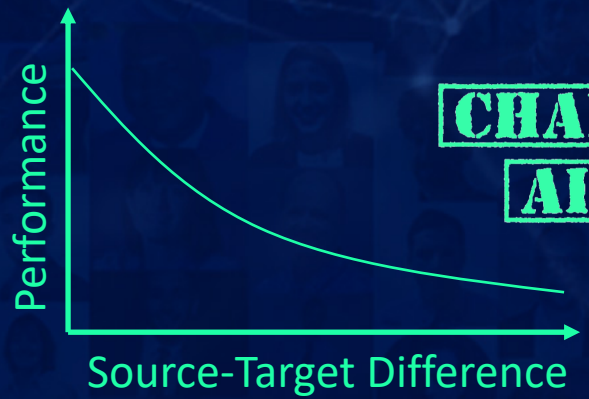
We dream of *interpretable* systems

- Posteriors are relative to a *domain*.
- *Source*: domains for which it is possible to have data to train ML/AI models.
- *Target*: domains in which the models are used, usually unknown in advance.
- Domains are a cornerstone to *interpret* the posteriors and make the right decisions !

My developers chose an abritrary domain to train me in the lab, but I'm driving in another one !

We dream of *reliable* systems

- We want *reliable* systems that are able to adapt on the fly to changing domains, without any retraining.
- To avoid significant performance drops, we need *on-the-fly domain adaptation*.



CHALLENGE OF PUSHING AI OUT OF THE LAB

I should dynamically adapt the posteriors I compute to the dynamically changing domain !

Mixtures of domains

- Choose several source domains, for which we have pretrained ML/AI models
- Often, the target domain can be expressed as a mixture of these source domains
- Goal: to « combine » the outputs of the various models to obtain the posteriors for the target domain
- This problem is the *on-the-fly mixture domain adaptation*

THIS IS NOT STRAIGHTFORWARD, BUT LET'S DO IT!

The online weather service tells me I should expect 70% sunny, 15% cloudy, 10% rainy, 5% foggy, and 0% snowy.

Our contributions

APPROVED BY THE SCIENTIFIC COMMUNITY

open-source code
GitHub + TRAIL Factory

peer-reviewed paper
WACV 2023

videos
YouTube

EASY AND POWERFUL
MAKE IT YOURS NOW !

new algorithm

experimental validation
CityScapes + BDD100K + Carla

problem analysis
mathematical solution

An overview of our method

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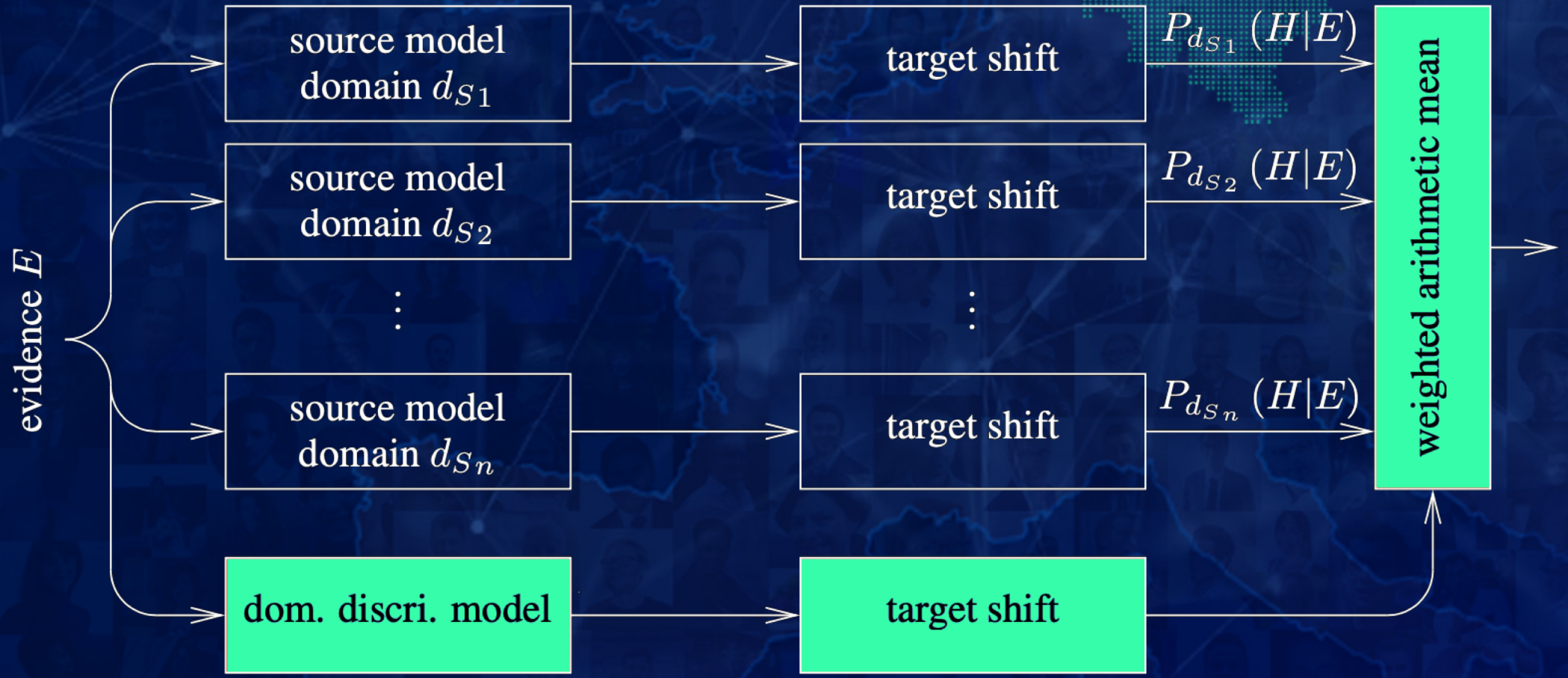
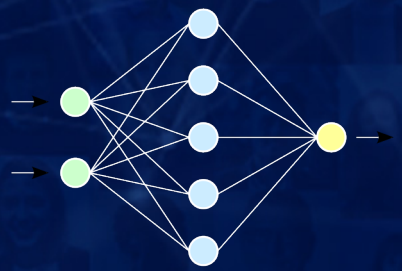
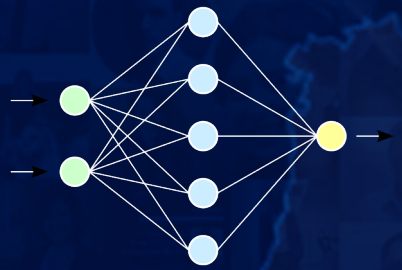


Recap: steps to push AI out of the lab

1a Training source models



1b Training a domain discriminator model



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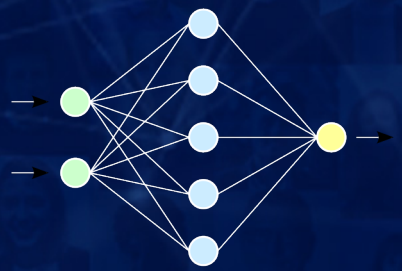
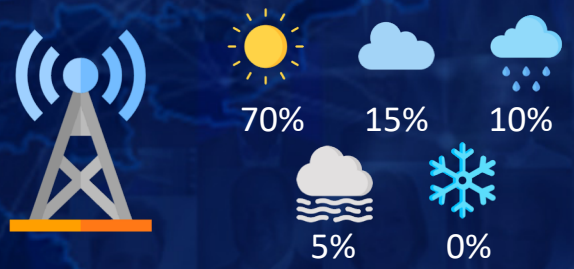
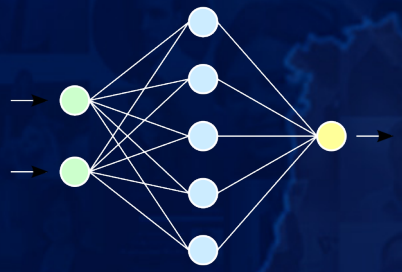


2a Finding information about the target domain



1b Training a domain discriminator model

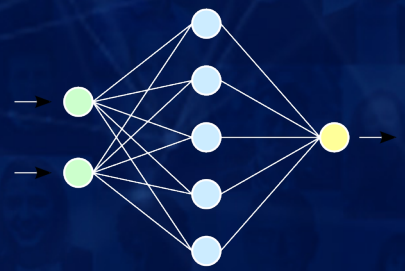


2b Linking the target and source domains

$$d_T = 70\%\, d_{S_1} + 15\%\, d_{S_2} + 10\%\, d_{S_3} + 5\%\, d_{S_4} + 0\%\, d_{S_5}$$

Recap: steps to push AI out of the lab

1a Training source models



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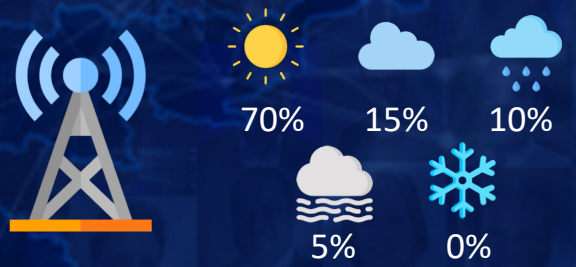
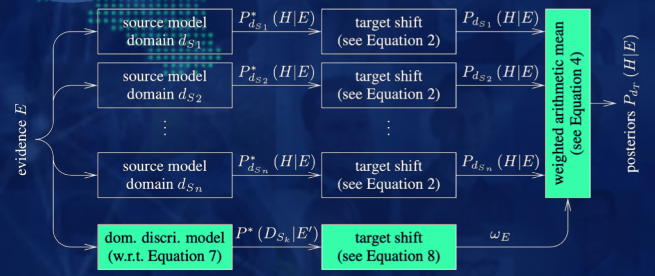
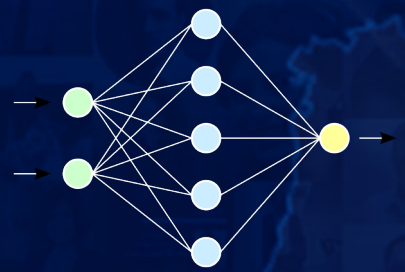


3 Applying our algorithm



1b Training a domain discriminator model



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EASY AND POWERFUL
MAKE IT YOURS NOW !

Adopt this research !

S. Pierard, A. Cioppa, A. Halin, R. Vandeghen, M. Zanella, B. Macq, S. Mahmoudi, and M. Van Droogenbroeck.
"Mixture Domain Adaptation to Improve Semantic Segmentation in Real-World Surveillance. »
In *Proceedings of IEEE/CVF Winter Conference on Applications of Computer Vision (WACVW)*, 22-31. IEEE, 2023.

CVF

GitHub

YouTube

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