

Task2Sim : Towards Effective Pre-training and Transfer from Synthetic Data

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Issues with Large Real-Image Datasets for Pre-training

Cost (Labeling, Cleaning, Storage etc.)

Privacy/Ethical Concerns

OR

Instagram 3.5B

Promising workaround : Pre-training with Synthetic Data

Transfer Knowledge to

Downstream Tasks from Various Domains (Real Images)

ChestX

Sketch

Flowers

SVHN

EuroSAT

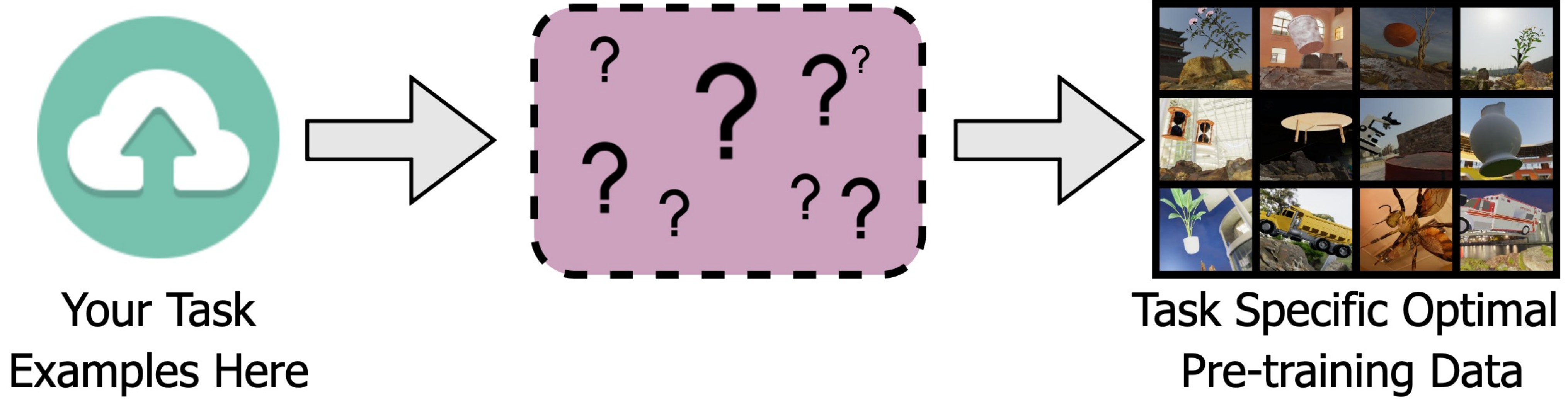
Synthetic Data Parameterization

Objects and Backgrounds

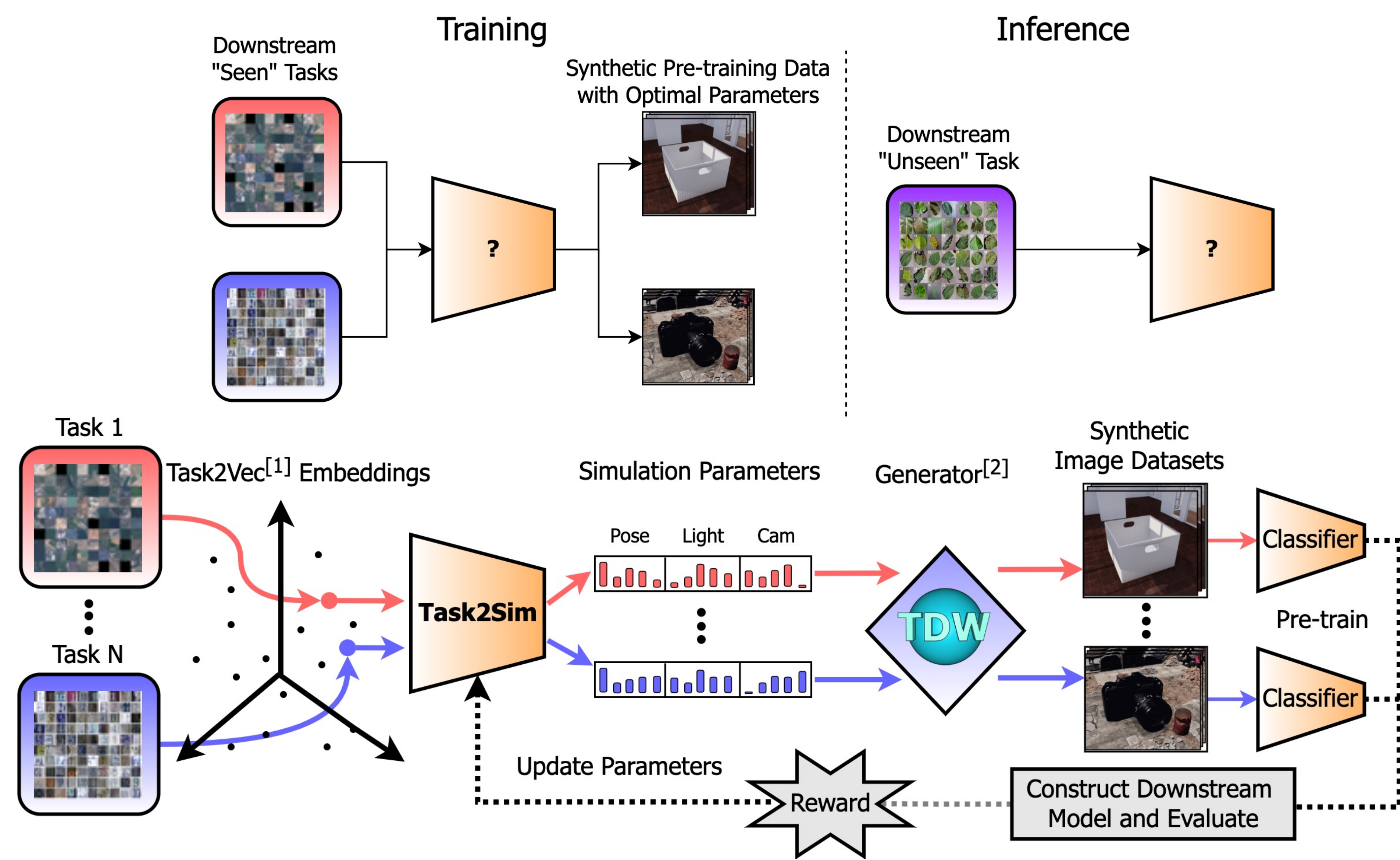
Scene Lighting

Object Materials

- How to find best parameters for downstream performance?
- Are they the same for different downstream tasks?

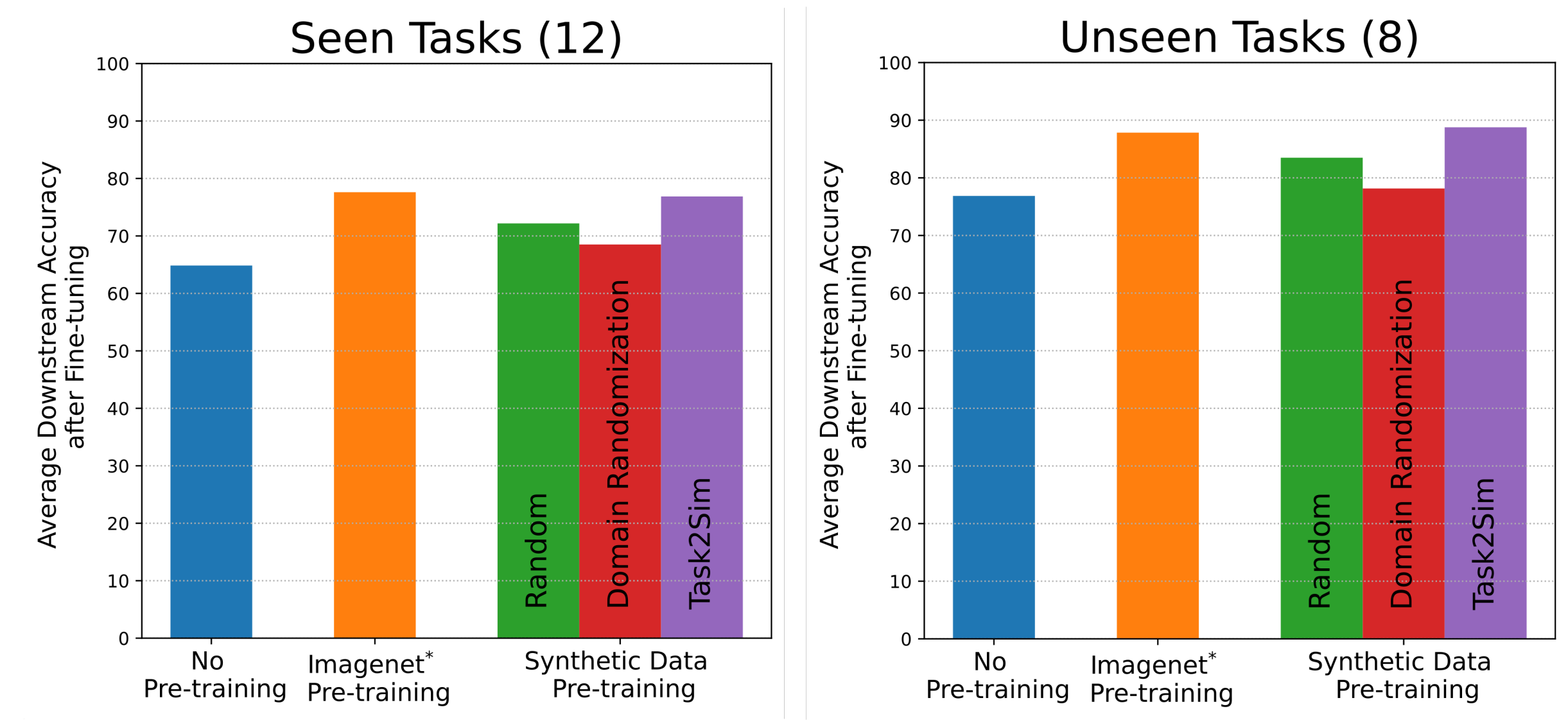


Finding best parameters too expensive per-task? Not if a generalizable predictor can be learned



Experiments

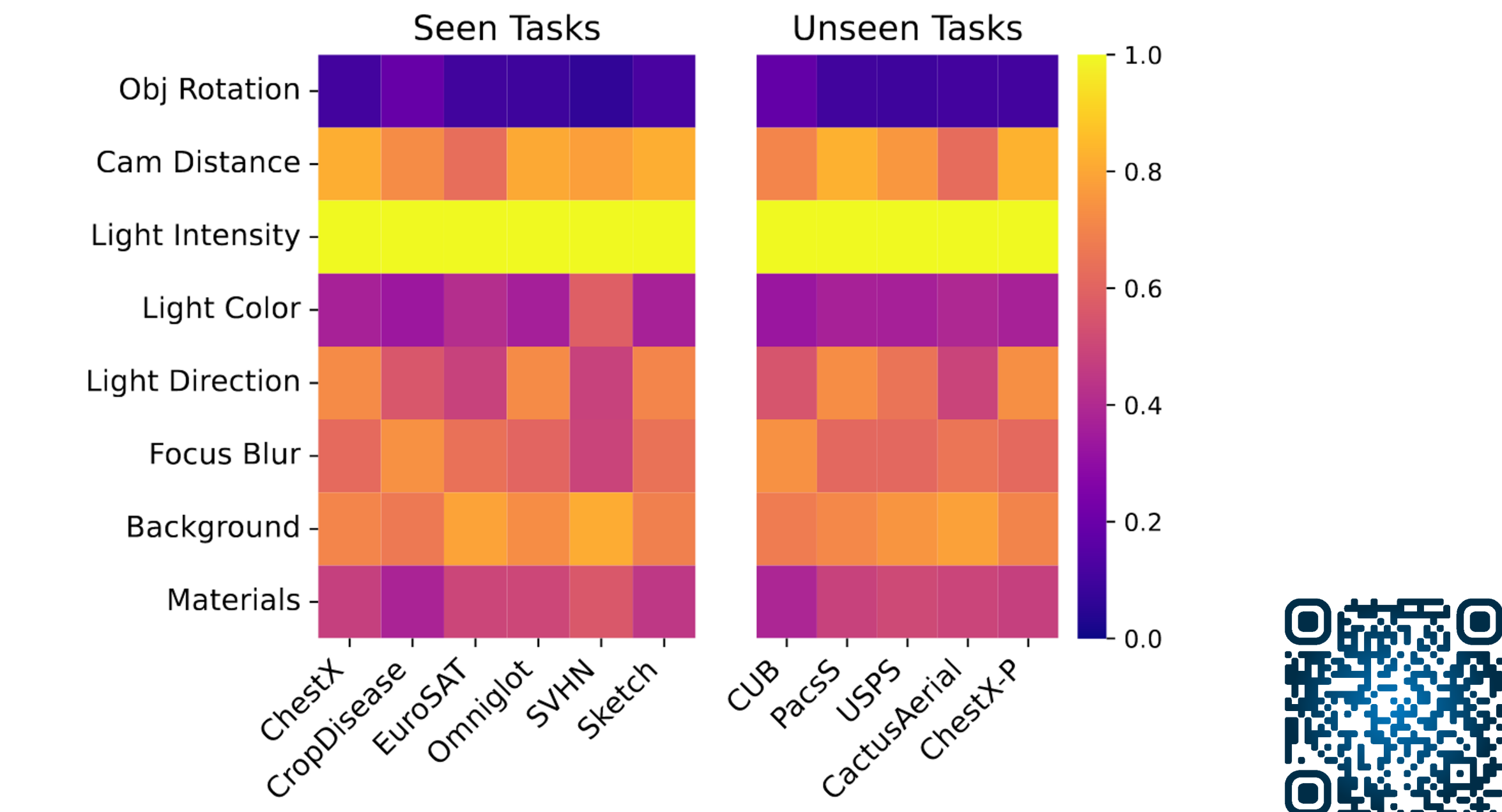
- Synthetic data : Images of single objects on backgrounds
 - Total 2322 different object models
- Simulation Controls : 8 binary parameters
 - 0 : variation in dataset OFF
 - 1 : variation in dataset ON
- Downstream Tasks : 12 seen, 8 unseen img classification tasks



*Indicates subset of Imagenet with same number of total images and total object classes as in synthetic data

- Task2Sim at par with Imagenet* pre-training and better than other baselines for simulation parameter selection in synthetic data.
- It generalizes to unseen tasks, maintaining performance trend.

Task2Sim Outputs



[1] Achille, Alessandro, et al. "Task2vec: Task embedding for meta-learning." Proceedings of the IEEE/CVF International Conference on Computer Vision. 2019.
 [2] Gan, Chuang, et al. "Threedworld: A platform for interactive multi-modal physical simulation." NeurIPS 2021 Track Datasets and Benchmarks.

