Task Discovery

Student: *Andrei Filatov*
Research Advisor: *Name Surname*
Co-Advisor (if any): Name Surname

December, 2021

Skoltech

Motivation

The machine/deep learning methods are highly dependent on task that its are solving.
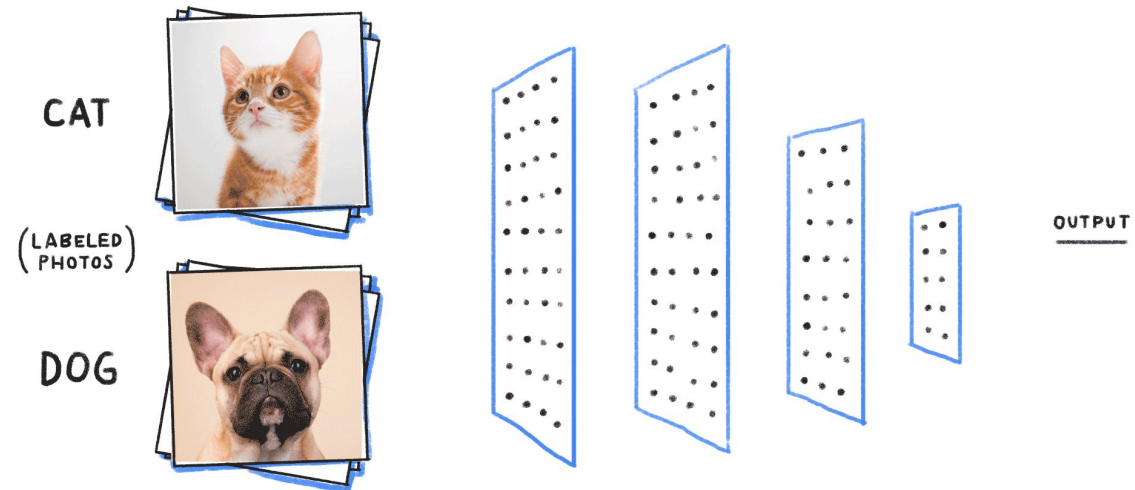
But very small attention is paid to task that used in learning

Task definition

$$\tau : X \rightarrow Y$$

X - input data (image)
Y - label (cat or dog; depth map)

Aim and objectives

We want to:

- Construct a procedure that generates new task

- Construct a metric for assessing the task.

Agreement Task Score
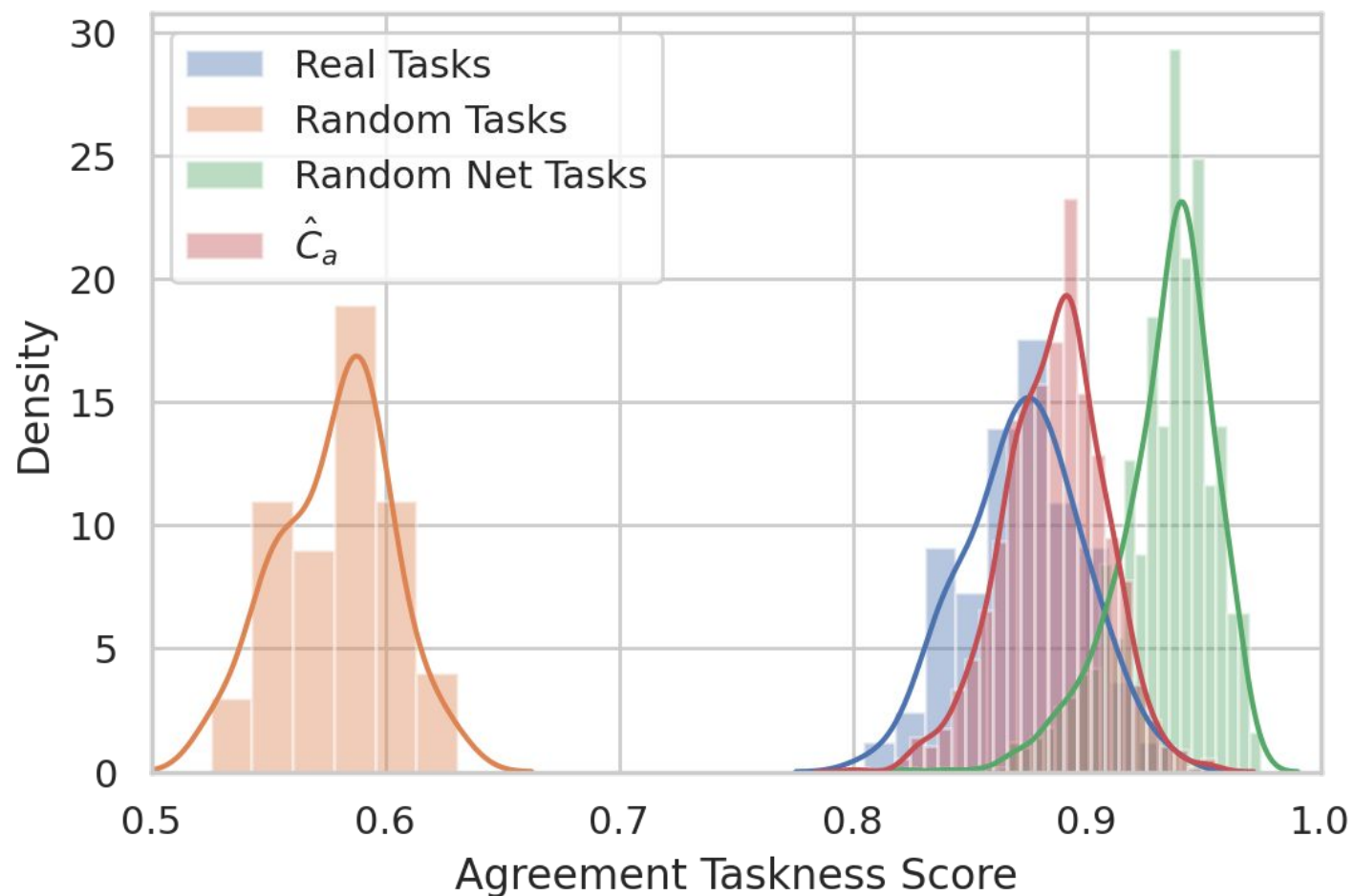
Input:

- unlabelled dataset $U = \{x_i\}_{i=1}^{N}$
- NN architecture $f(\cdot; \phi)$
- task $\tau : U \to \mathcal{Y}$

Algorithm to compute

1. $U = U_{tr} \cup U_{val}$
2. $\phi_1 \leftarrow SGD(\{(x, \tau(x)) \mid x \in U_{tr}\}, seed_1)$
3. $\phi_2 \leftarrow SGD(\{(x, \tau(x)) \mid x \in U_{tr}\}, seed_2)$
4. $L(\phi_1, \phi_2) = \sum_{x \in U_{val}} l(f(x; \phi_1), f(x; \phi_2))$ // measure the loss between 2 models
5. Output: $s(\tau \mid U) = -L(\phi_1, \phi_2)$

Skoltech

Agreement Task Score

Meta optimization

1. For k = 1....

    1. $P_\tau = \emptyset$

    2. $\theta_0 \sim p(\theta)$// random init

    3. While number of "1" $\notin [0.45, 0.55]$ and ATS < 0.8 and similarity < 0.7:

        1. $\mathcal{L} = -s(T_\theta \,|\, U) + \lambda_1 \cdot \Omega(\theta, P_\tau)$

        2. $\theta_{t+1} \leftarrow \theta_t - \alpha \cdot \nabla_\theta \mathcal{L}|_{\theta=\theta_t}$

    4. $P_\tau \leftarrow P_\tau \cup \{T_{\theta_t}\}$

Skoltech

Results

- Proposed the metric fo task assessing

- Proposed the procedure for finding new tasks

Plans

1. Generate more tasks

2. Construct task groups

3. Investigate over metrics for task assessment

4. Speed up the procedure

Skoltech