# Multi-Task Learning

- **MTL approach 1** :
  - A clustered or low-rank structure between the tasks is known *a priori*
- **MTL approach 2** :
  - The task relationships are not known beforehand
  - It can be learned from the data

**MTL** can address the *statistical challenges* of federated learning

Currently proposed methods for distributed **MTL** don't adequately address the *systems challenges*

Federated Multi-Task Learning, NIPS, 2017

# Federated Multi-Task Learning

## General Multi-Task Learning Setup

- General formulation :

$$\min_{W,\Omega} \quad \left[ \sum_{k=1}^{K} \sum_{i \in \mathcal{P}_k} f_k(w_k^\top x_k^i, y_k^i) + \mathcal{R}(W, \Omega) \right]$$

$\Omega \in \mathbb{R}^{K \times K}$ models *relationships among tasks*. $f_k$ is a convex loss function.

- MTL problems differ based on their assumptions on $\mathcal{R}$

$$\mathcal{R}(W, \Omega) = \lambda_1 \, tr\left(W \Omega W^\top\right) + \lambda_2 \, | \, W |_F^2$$