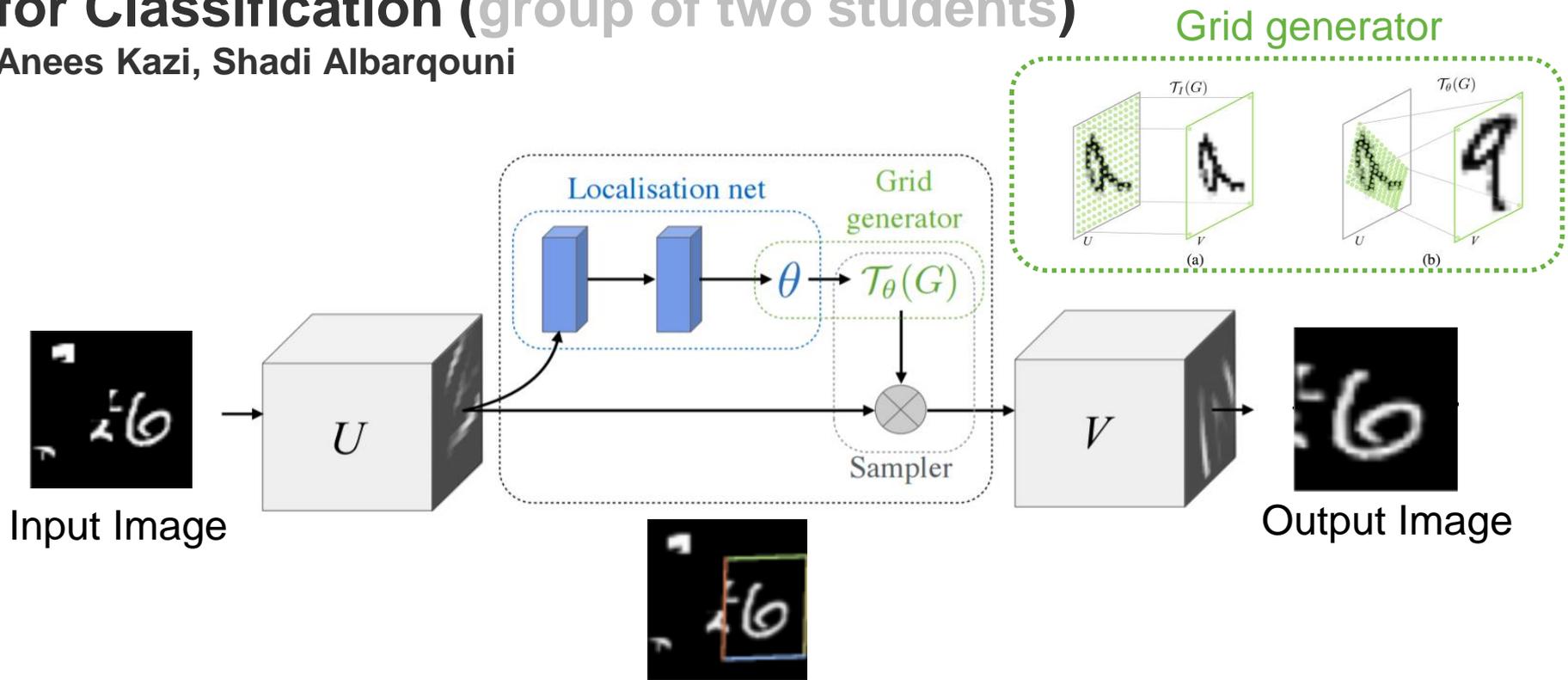


# Understanding Spatial Transformation Network (STN)<sup>1</sup> for Classification (group of two students)

Anees Kazi, Shadi Albarqouni



$$\begin{pmatrix} x_i^s \\ y_i^s \end{pmatrix} = \mathcal{T}_\theta(G_i) = \mathbf{A}_\theta \begin{pmatrix} x_i^t \\ y_i^t \\ 1 \end{pmatrix} = \begin{bmatrix} \theta_{11} & \theta_{12} & \theta_{13} \\ \theta_{21} & \theta_{22} & \theta_{23} \end{bmatrix} \begin{pmatrix} x_i^t \\ y_i^t \\ 1 \end{pmatrix}$$

<sup>1</sup> Jaderberg, M., Simonyan, K., & Zisserman, A. (2015). Spatial transformer networks. In *Advances in Neural Information Processing Systems* (pp. 2017-2025).



# Understanding Spatial Transformation Network (STN)<sup>1</sup> for Classification (group of two students)

**Milestone #1:** Understanding STN on distorted MNIST

## Required tasks:

- Implement the paper using TensorFlow (baseline).
- Study the effect of hyper-parameters on baseline classification.
  - Dataset size, No. of classes,
  - Robustness to noise, class imbalance and data augmentation.
  - Influence of Localization network

**Database: Distorted MNIST**

- Write a technical report and document the code (comments).  
Prepare the final presentation.

**Milestone #2:** Validating STN on clinical database

## Required tasks:

- Replace both localization and classification shallow networks with pre-trained GoogleNet.
- Validate the proposed pipeline for 2 (Normal/Abnormal) and 3 classes (Normal/ Fracture type A / type B)

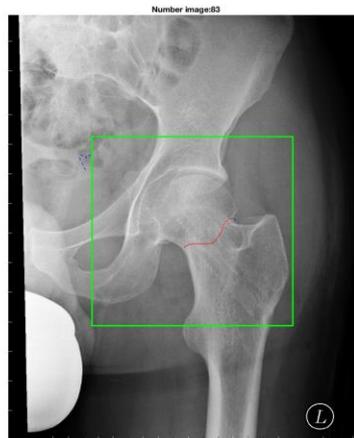
**Database: Femur X-ray images (1000 images with 2 and 3 classes)**



**Programming skills:** TensorFlow, Python

**Contact:** [anees.kazi@tum.de](mailto:anees.kazi@tum.de)

# Dataset: Femur Bone X-ray Radiographs



## Classification for

- 2 classes:  
Normal/ Abnormal
- 3 classes:  
A / B / Normal