

Variational Autoencoded Regression: High Dimensional Regression of Visual Data on Complex Manifold

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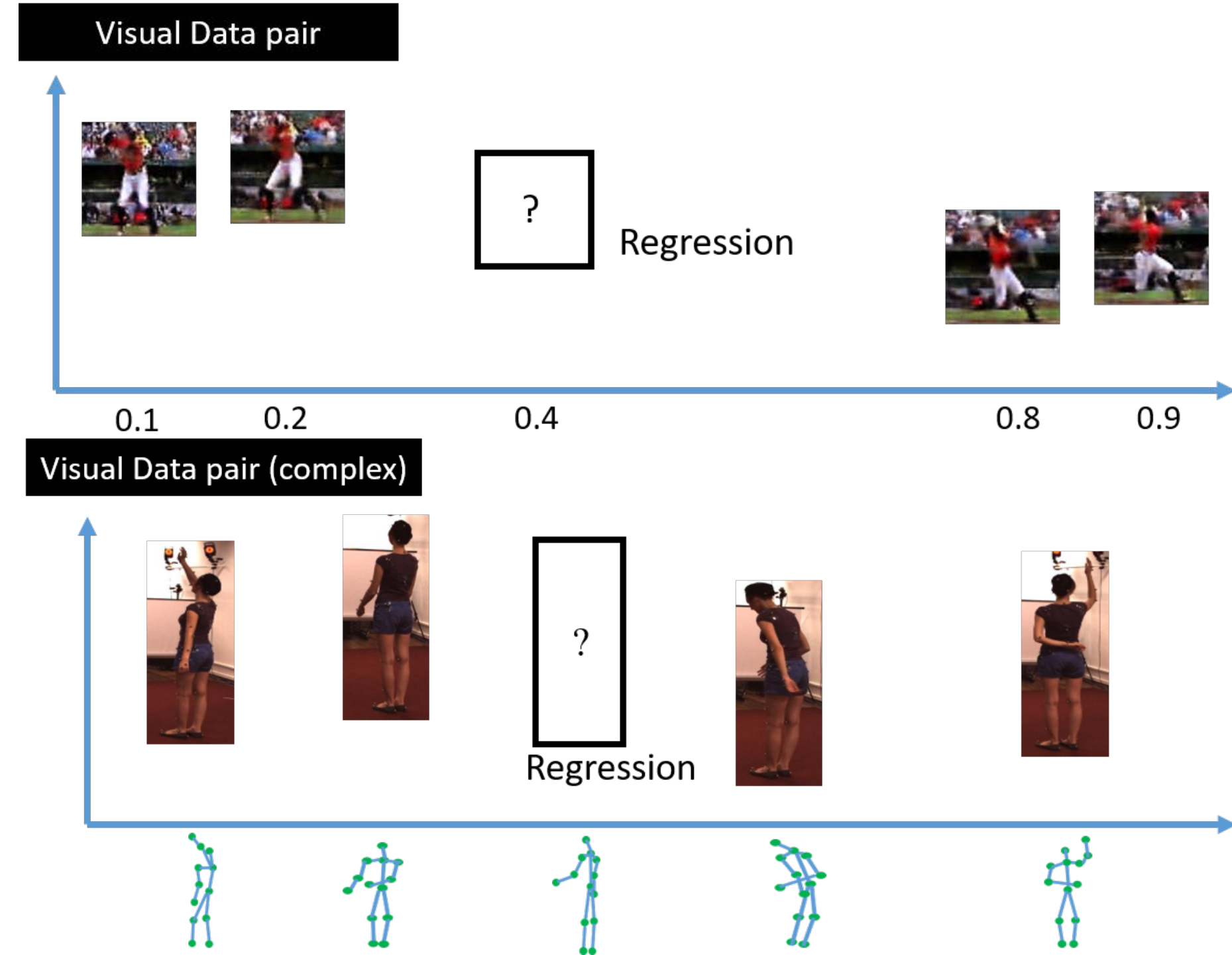


CVPR
2017
July 21-26
HONOLULU

Motivation

Regression for complex response

- Dealing with the case when output response is set to Image.



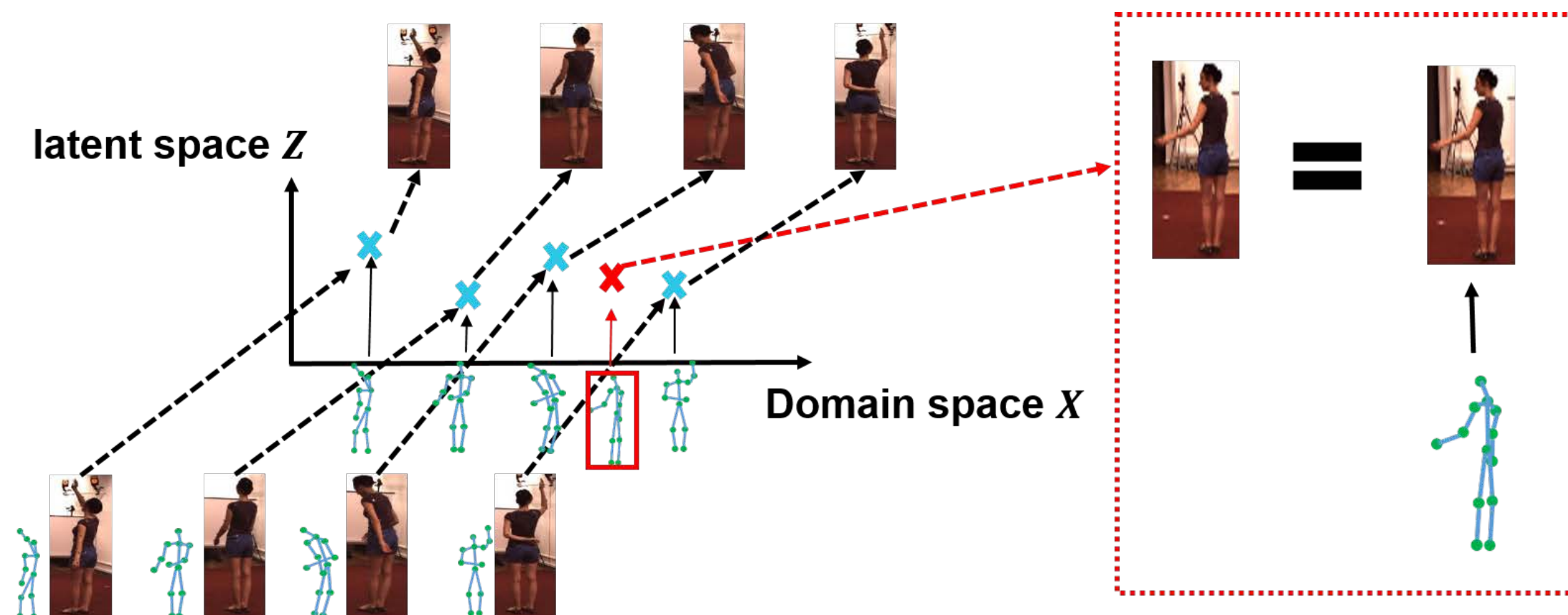
Problem

- Complex and high dimensionality of Images
- Difficult to regress, and generate the visual response.

Approach

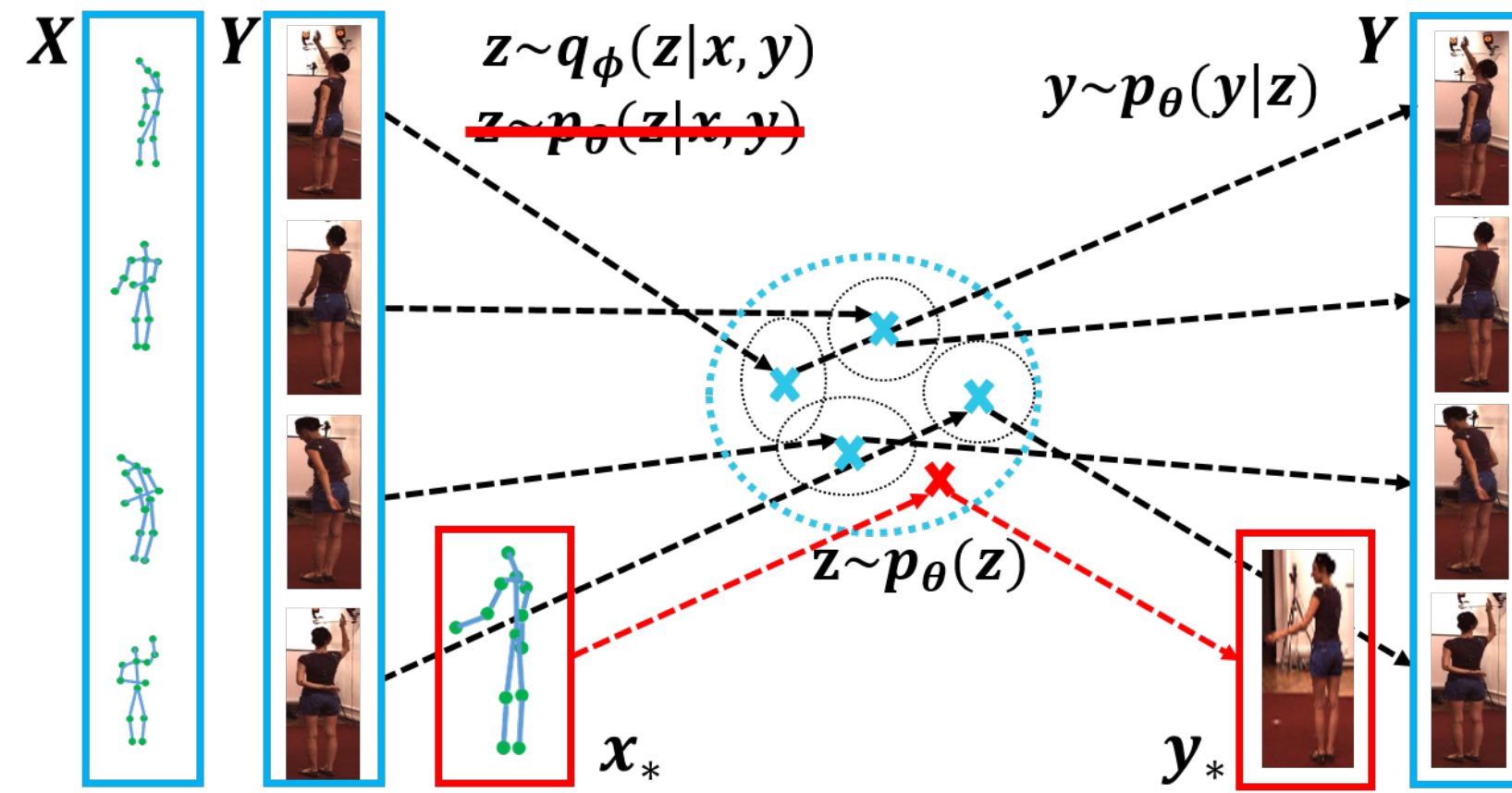
Variational Autoencoded Regression

- Map the visual data into low dimensional (latent) space
- Regression in latent space = Regression in Data space



Variational Autoencoded Regression (VAE-Regression)

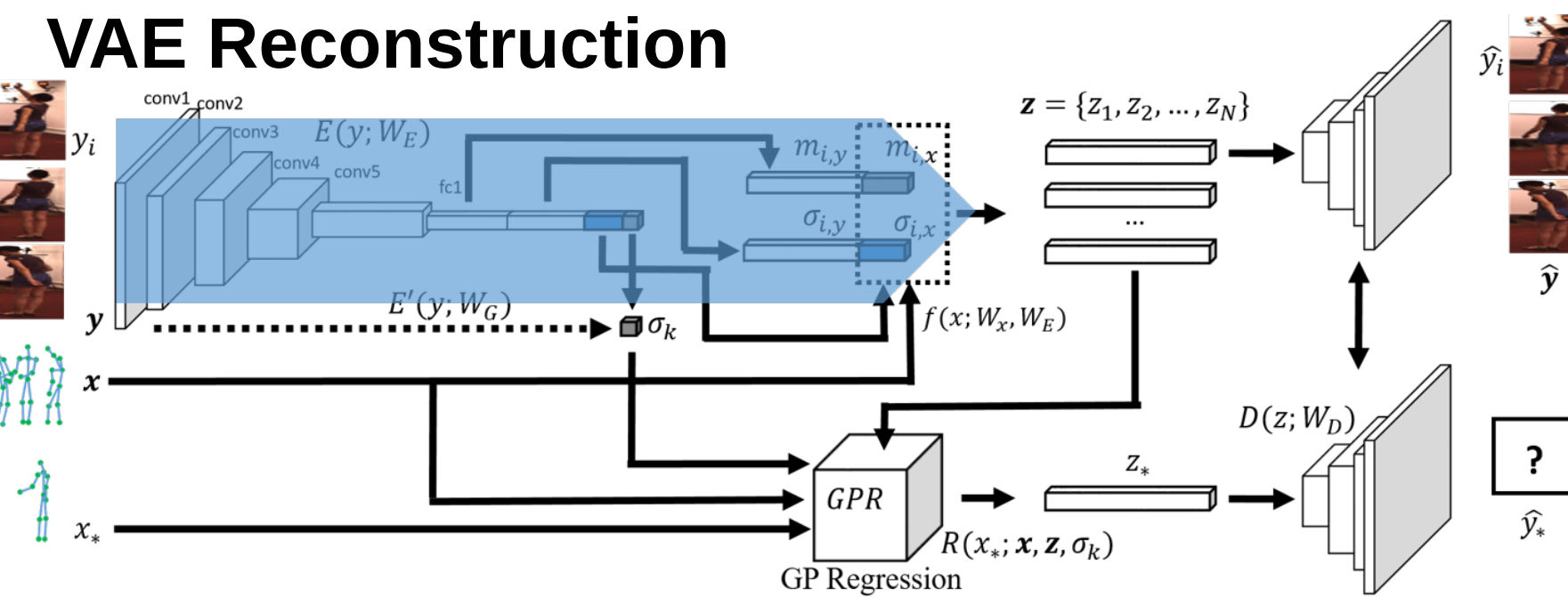
Problem Setting



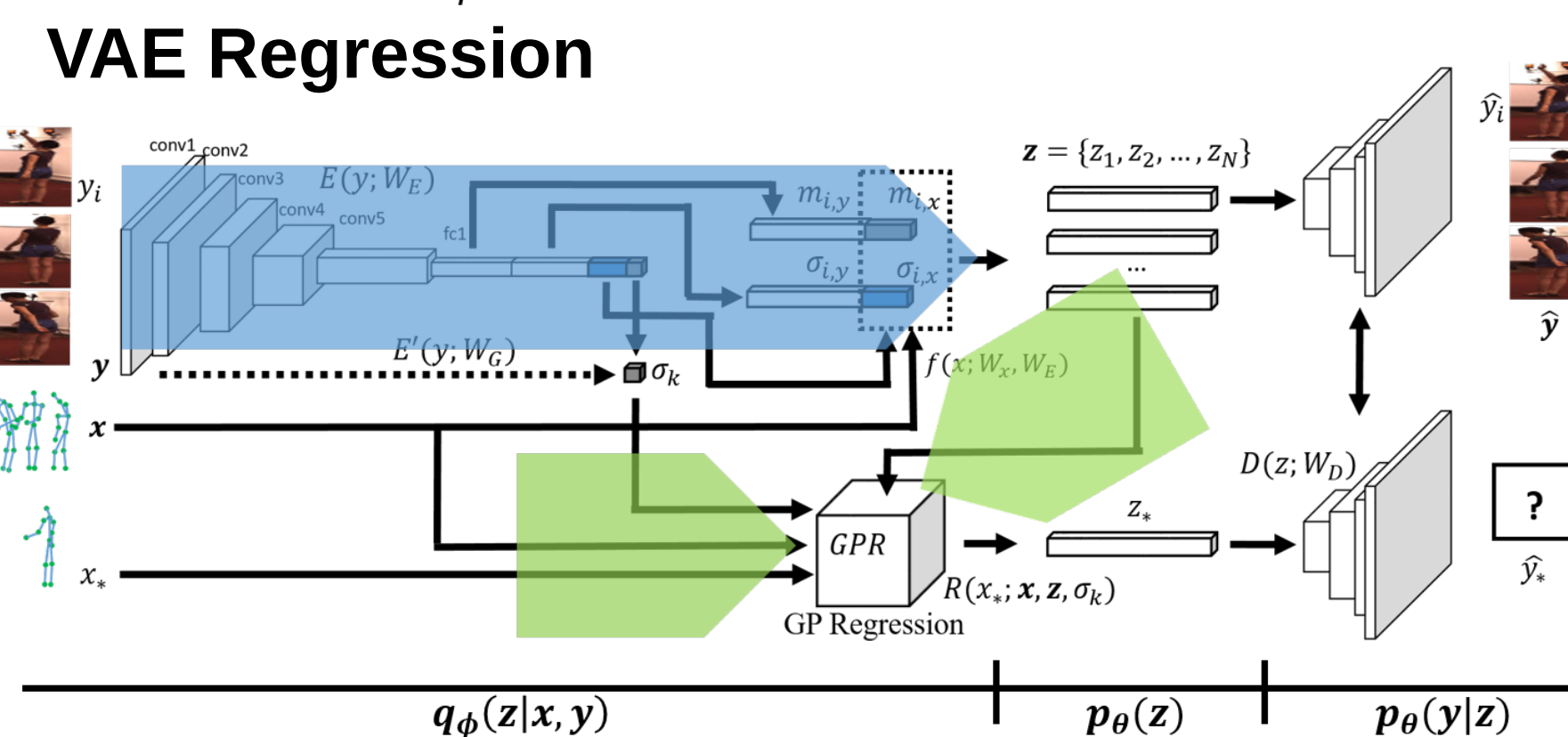
- Find $y_* \sim p_\theta(y|x_*, X, Y)$.
 - Minimize $D_{KL}(q_\phi(z|x, y) || p_\theta(z|x, y))$
- $$\cong -D_{KL}(q_\phi(z|x, y) || p_\theta(z)) + \sum_{i=1}^N \log p_\theta(\hat{y}_i | z_i) + \sum_{j=1}^M \log p_\theta(\hat{y}_j | \hat{z}_j)$$

- $p_\theta(z) \sim N(0, I)$
- $q_\phi(z|x, y) \sim N(m, \sigma)$ $z = z_i$
- $q_\phi(z|x, y) \sim GPR(z; X, Y, x_*)$ $z = z_j$

VAE Reconstruction

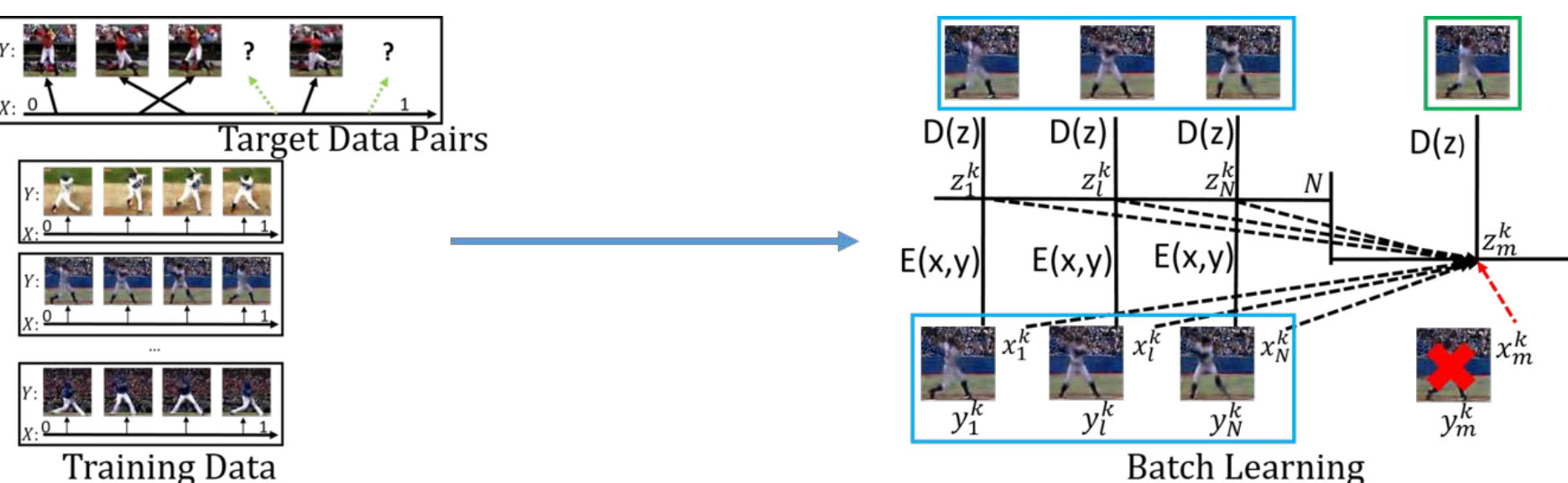


VAE Regression

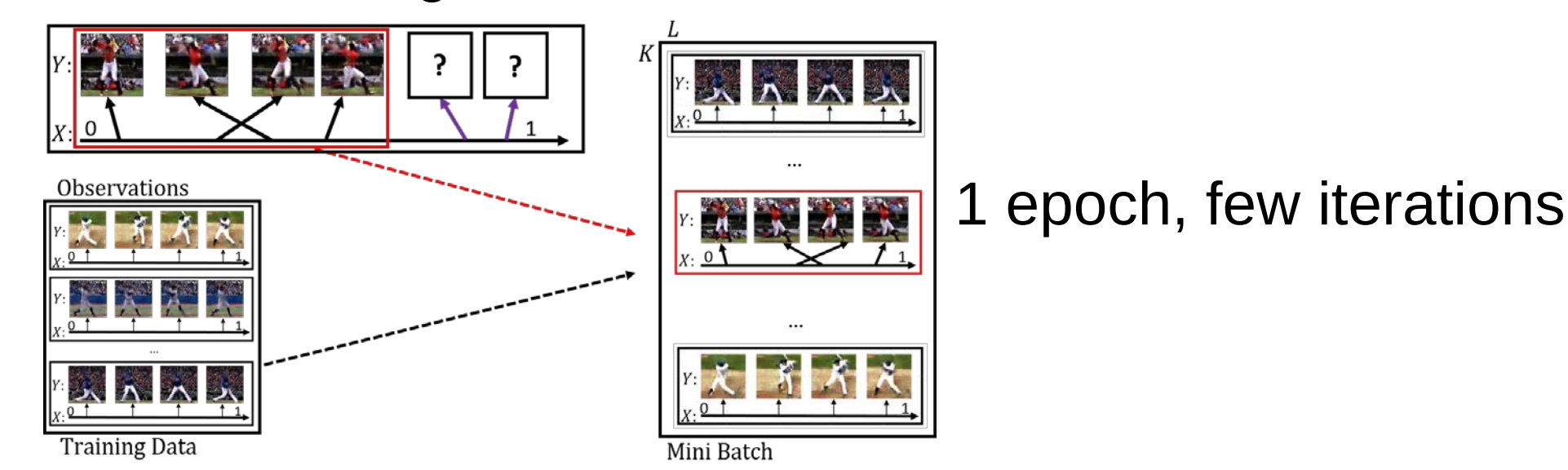


Training method

- Batch Generation



- Fine Tuning



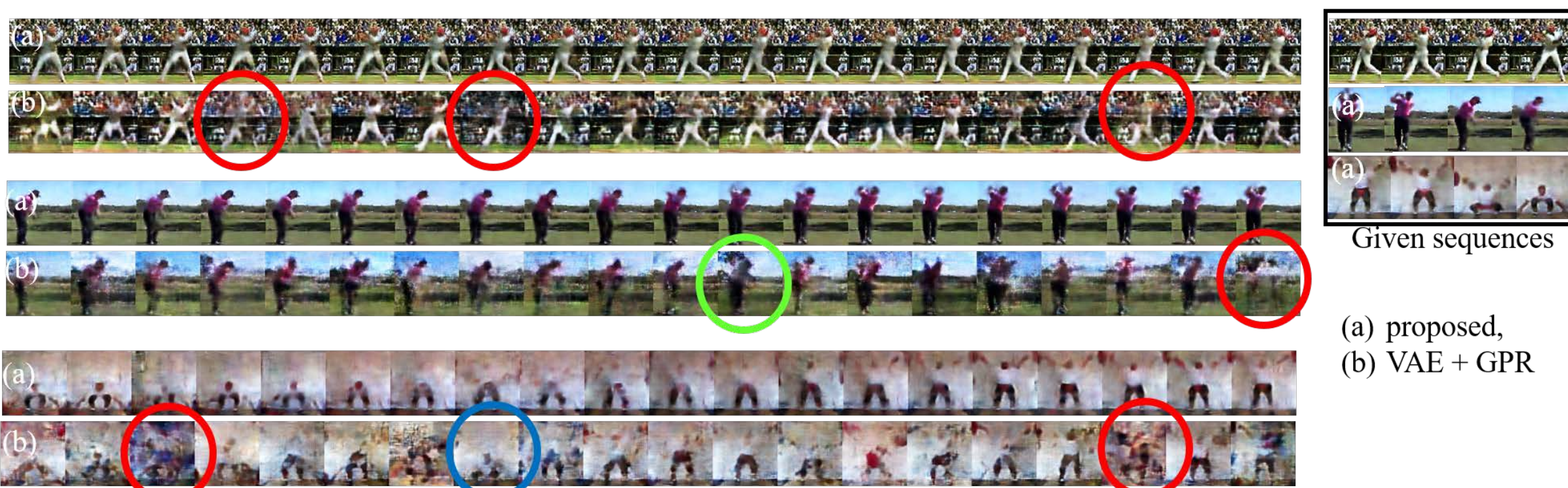
Experiments

Experiment setting

- Tensorflow, i7-4790K CPU, Nvidia Titan X GPU.
- H36m and Youtube captured dataset

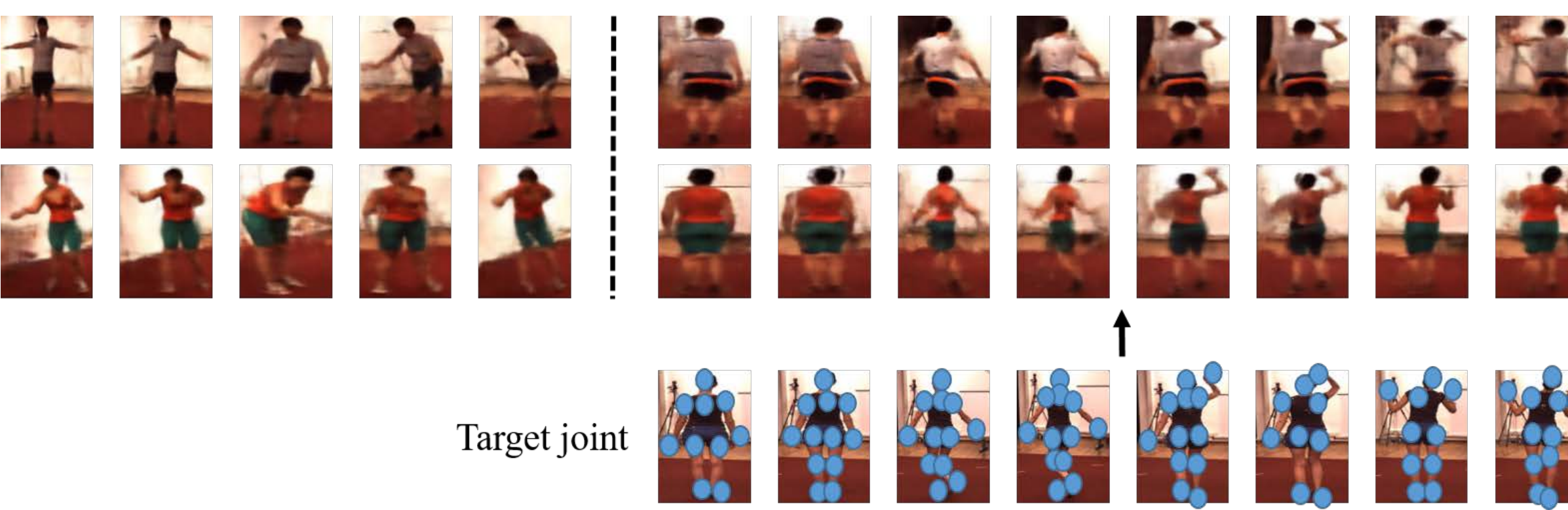
Simple Domain – Complex response

- Domain – relative order, Response – Image



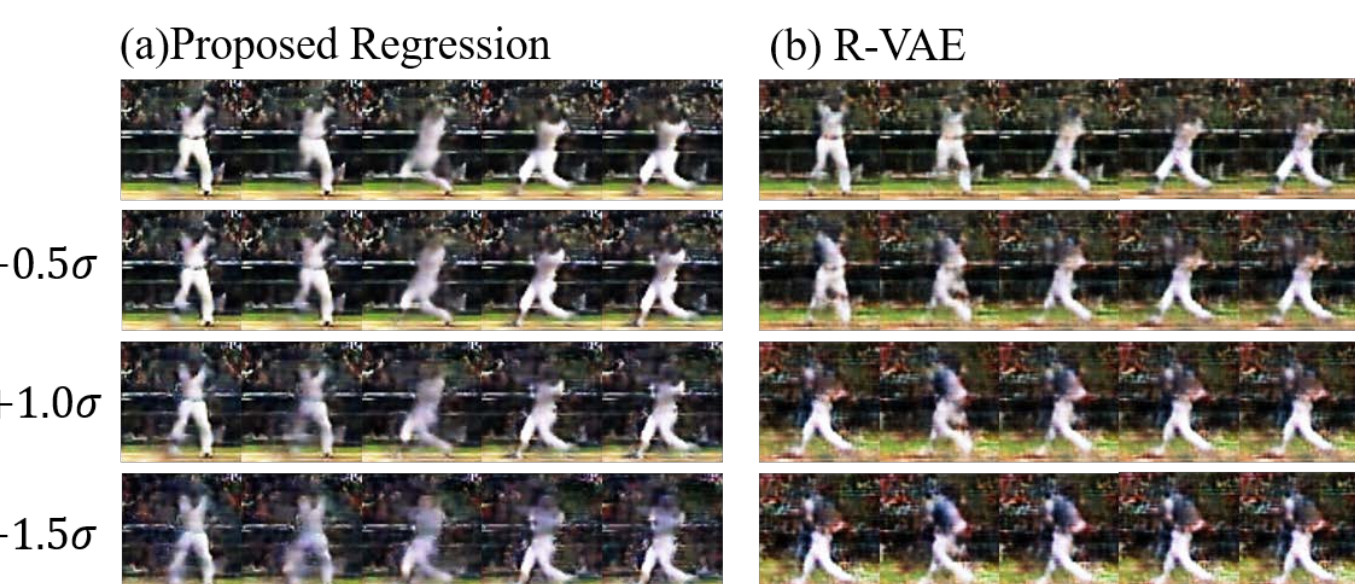
Complex Domain – Complex response

- Domain – Joint vector, Response – Image (256 by 256, adding GAN)



Further Analysis

1. Robustness



2. Convergence

