Neural Puppet: Generative Layered Cartoon Characters

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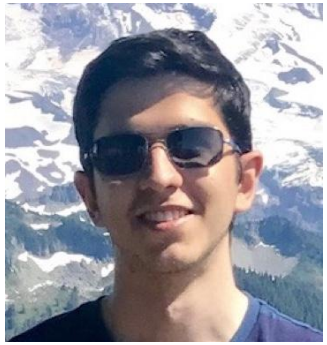
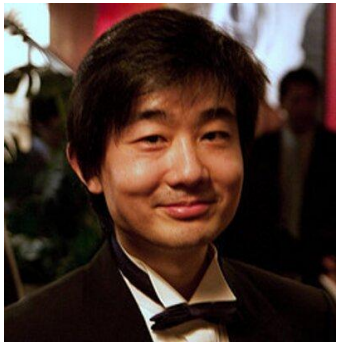
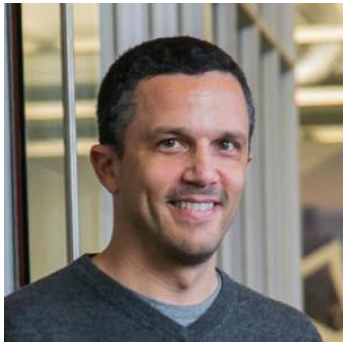


Motivation

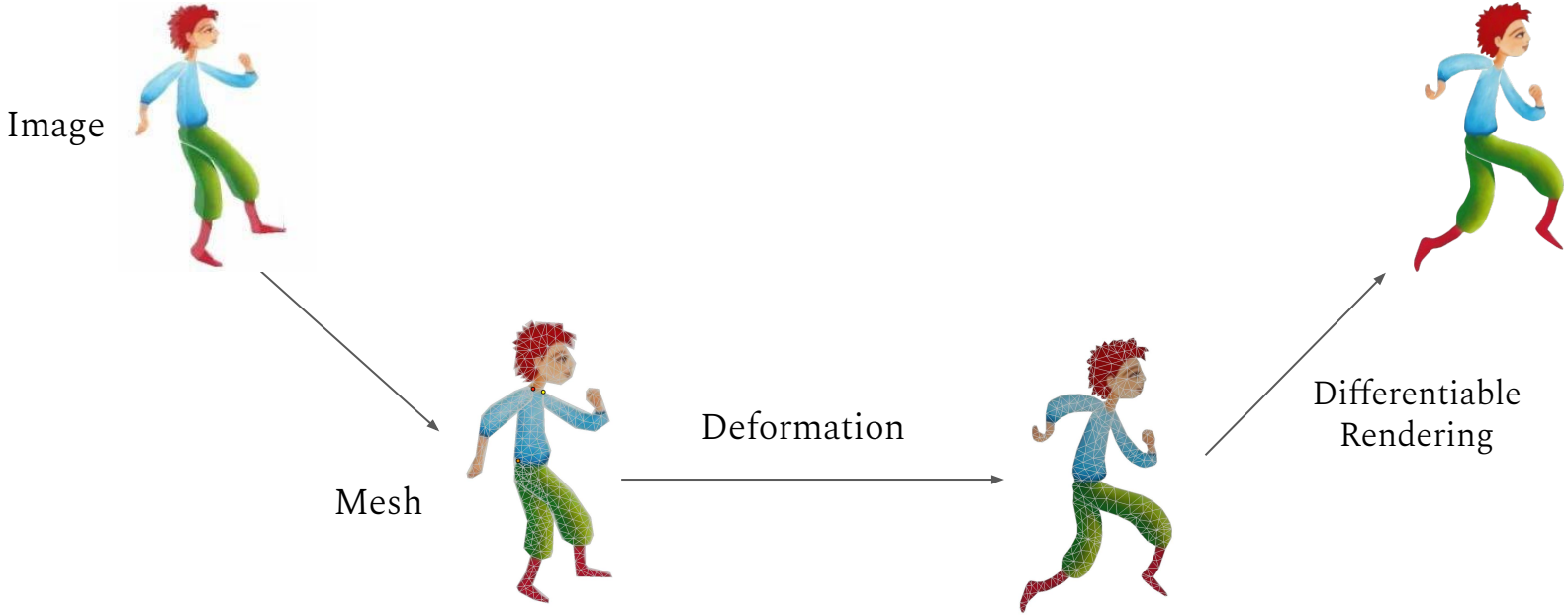
Generating motion in image / video is difficult

MoCoGAN, Tulyakov et al., CVPR 2018

Controllable Video Generation, Hao et al., CVPR 2018

Main Idea

Using an underlying mesh representation for deformation / interpolation



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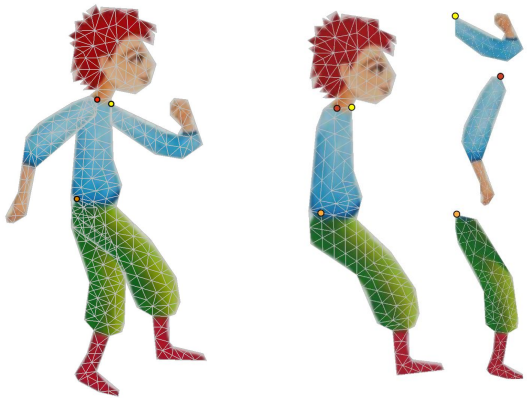
Main Idea

Advantages:

- Well-defined regularization energies on meshes
- Working in the lower dimensional space of vertex positions
- Alleviating blurry outputs

Template Mesh



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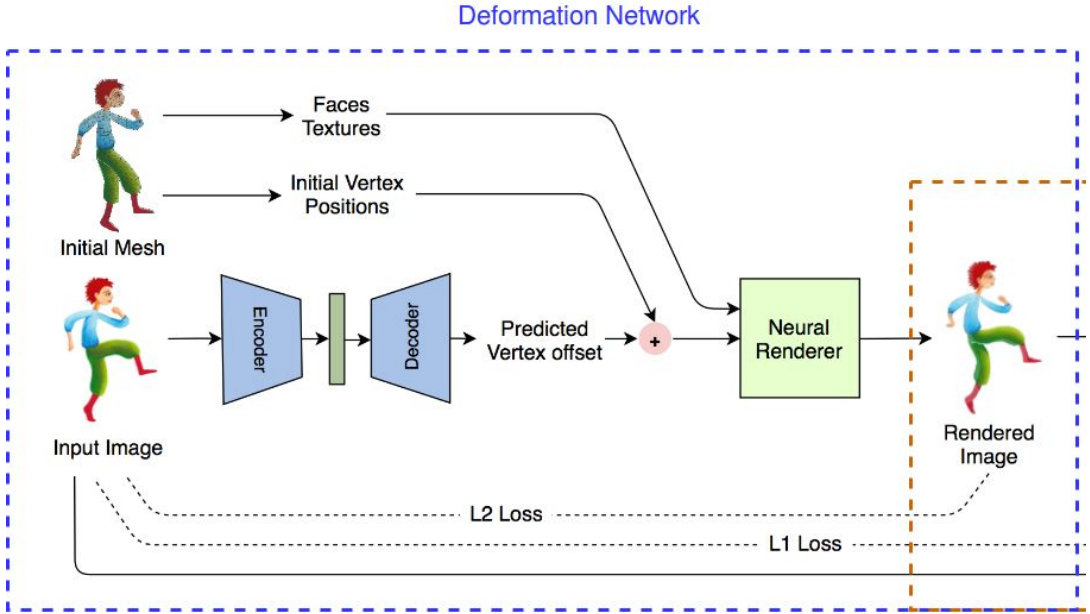
Architecture



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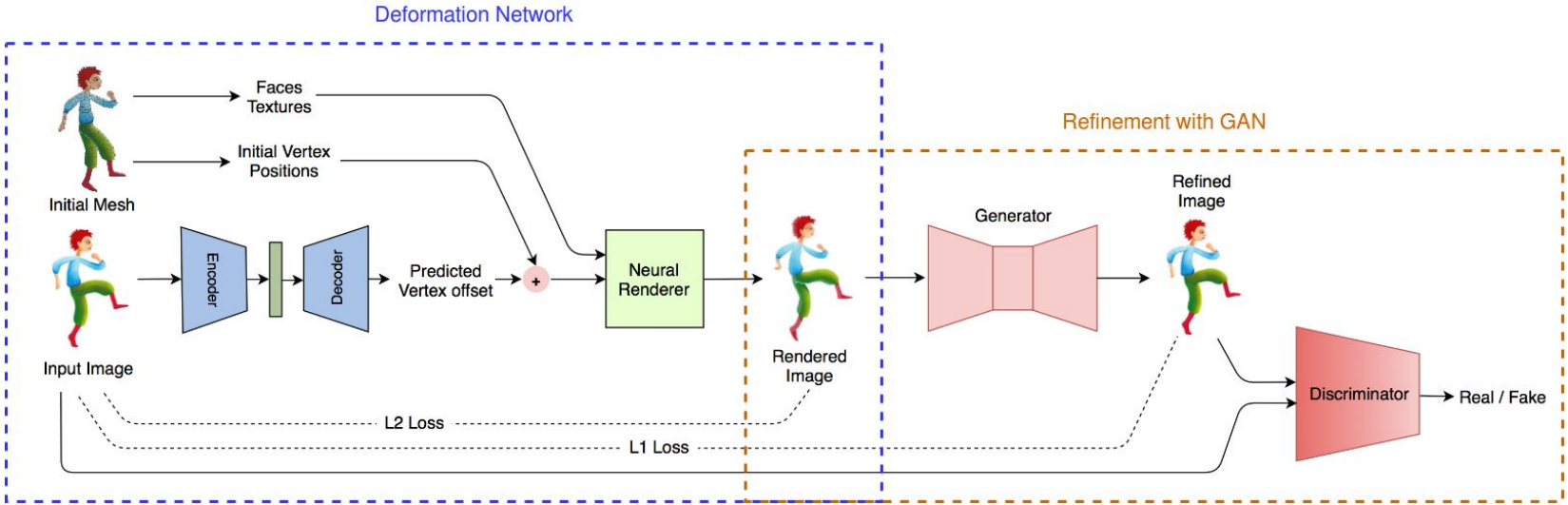
Architecture



$$L_{rec} = \|x - R(V_{pred}, F, I^{uv})\|^2$$

$$L_{joints} = \sum_{i=1}^{n} \|p_i - q_i\|^2$$

$$L_{reg} = \sum_{i=1}^{|V|} \sum_{j \in \mathcal{N}_i} w_{ij} \|(\hat{v}_i - \hat{v}_j) - R_i(v_i - v_j)\|^2$$

$$L_{total} = L_{rec} + \lambda_1 \cdot L_{reg} + \lambda_2 \cdot L_{joints}$$

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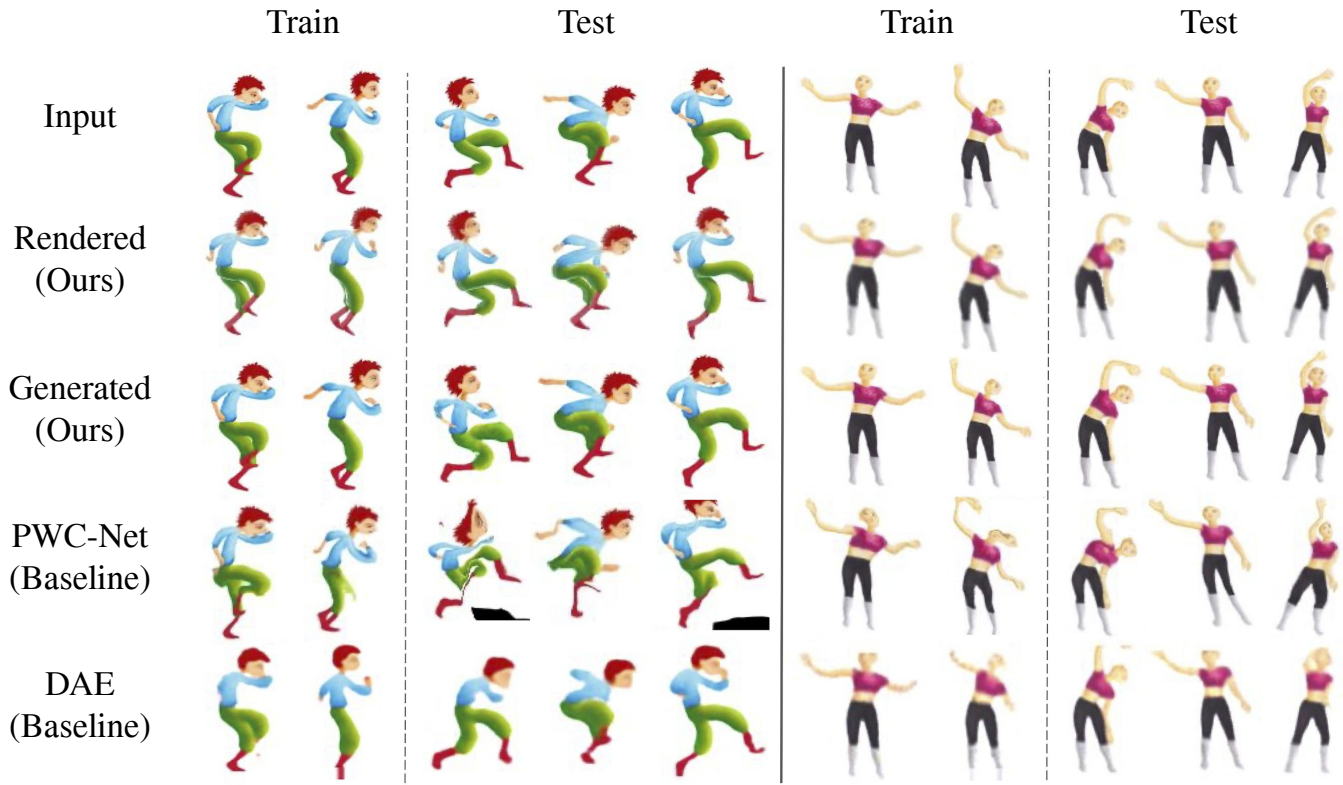
Results



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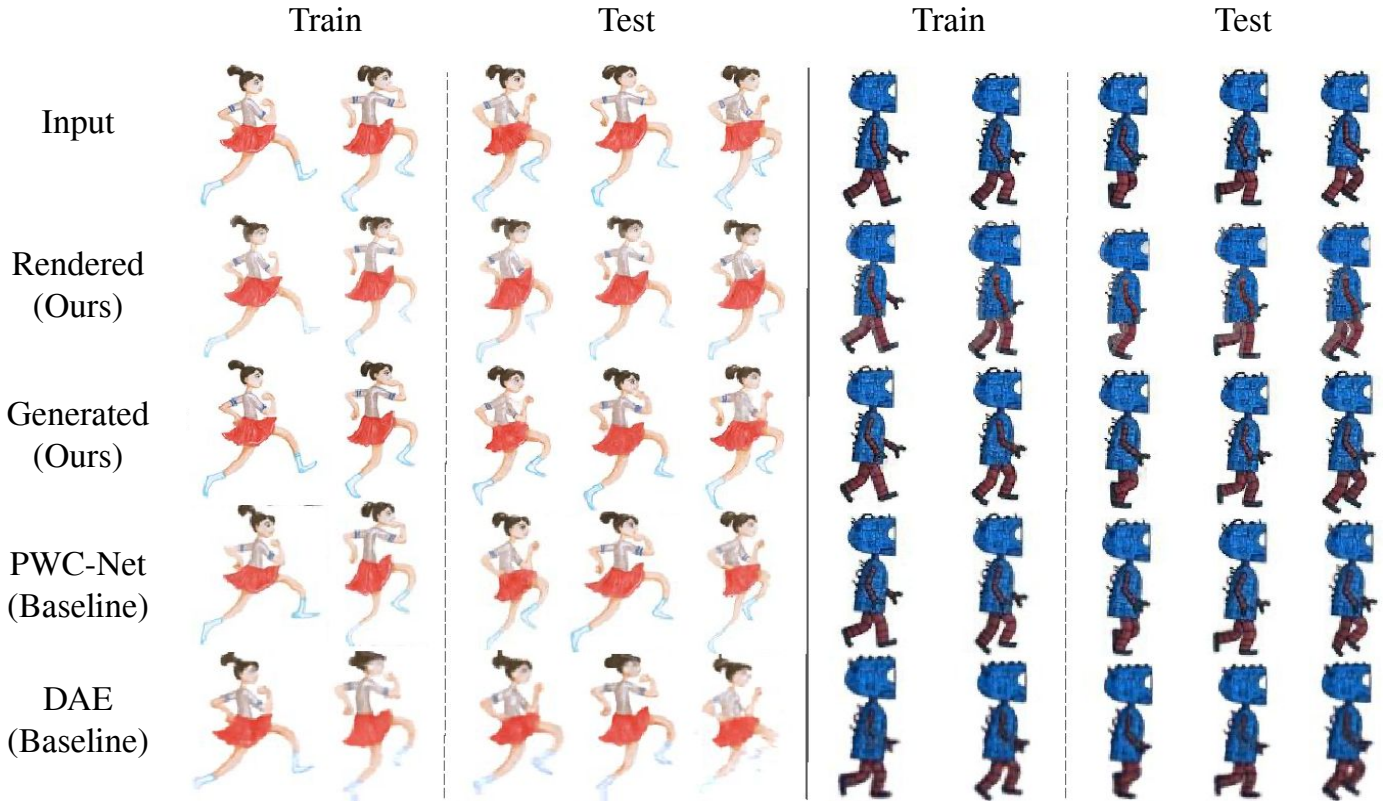
Results



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Results

Average L2 distance to ground truth

	Char1	Char2	Char3	Char4	Avg
Rendered	819.8	732.7	764.1	738.9	776.1
Generated	**710.0**	**670.5**	**691.7**	**659.2**	**695.3**
PWC-Net	1030.4	1016.1	918.3	734.6	937.1
DAE	1038.3	1007.2	974.8	795.1	981.6

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Interpolation between poses

Linearly interpolating between encoded latent vectors

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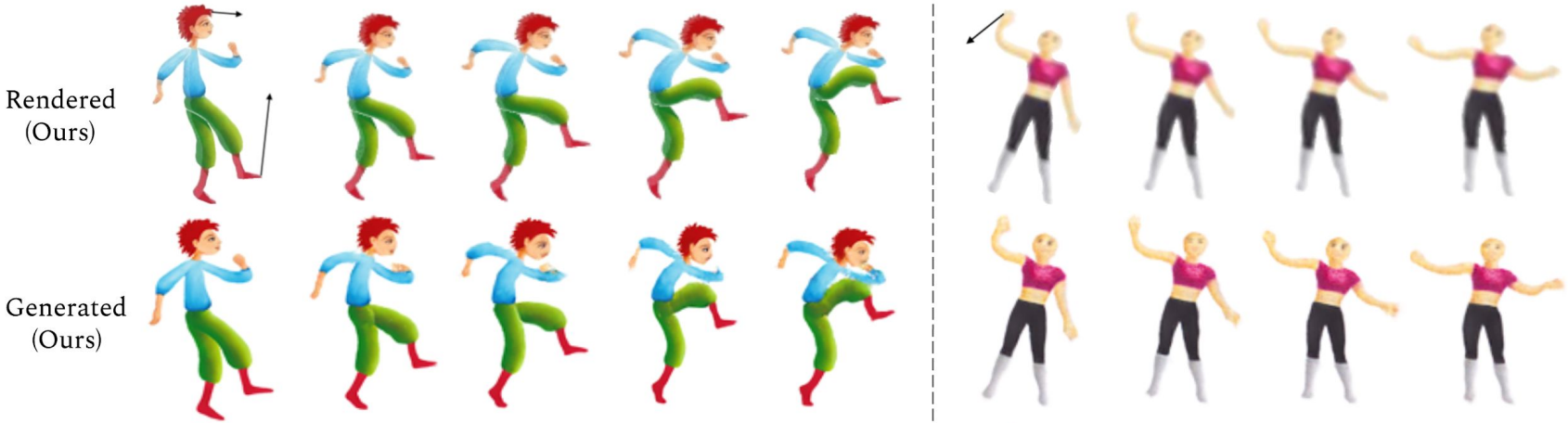
User-constrained Deformation

The user specifies a desired location for a point on the character

$$L_{user} = \sum_i \left\| p_i(\mathbf{v}) - p_i^{\text{trg}} \right\|^2 \qquad L_{deform} = L_{user} + \alpha_1 \cdot L_{reg} + \alpha_2 \cdot L_{joints} \qquad z \longleftarrow z - \eta \nabla_z L_{deform}$$



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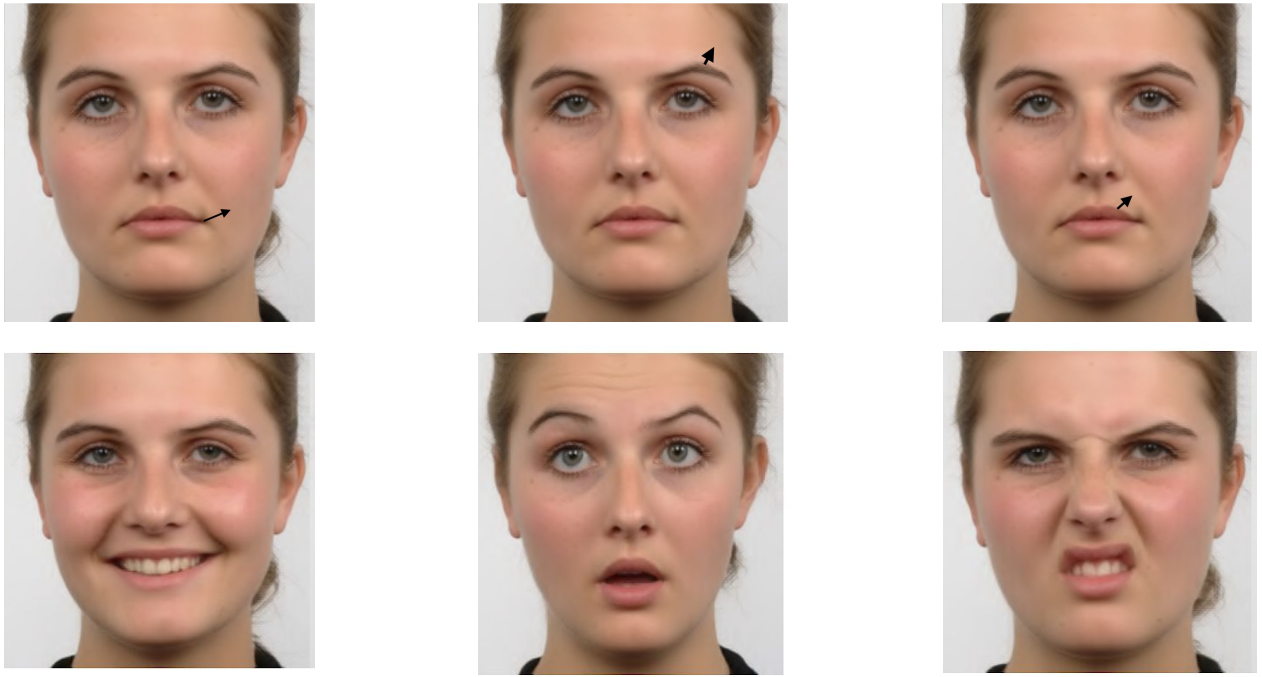
Applications: Face manipulation



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