

Motivations

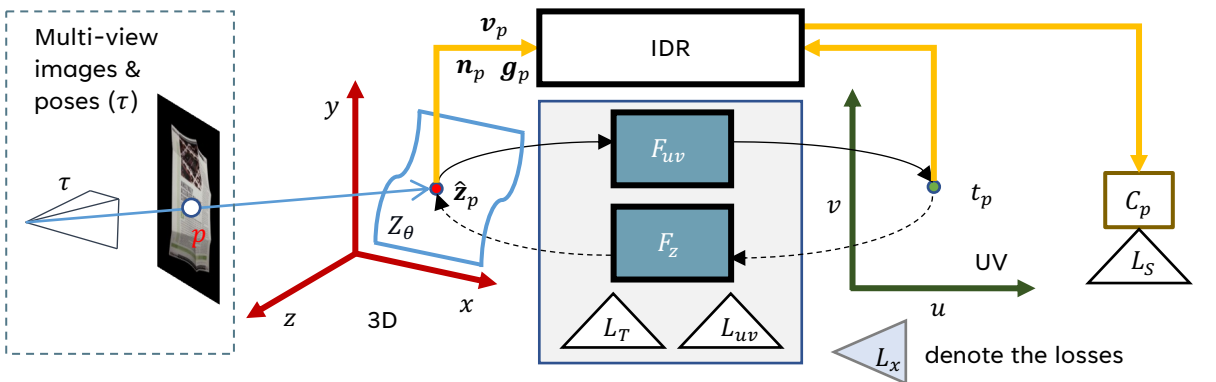
- Current neural shape representation approaches:
 - Do not allow a surface parameterization.
 - Do not allow editing or re-texturing of the surface.
- Document unwarping is a special case of texture unwrapping of an isometric surface:
 - Prior unwarping methods need a large paired dataset.
 - Utilizes single image, **geometrically under constrained**.

Contributions

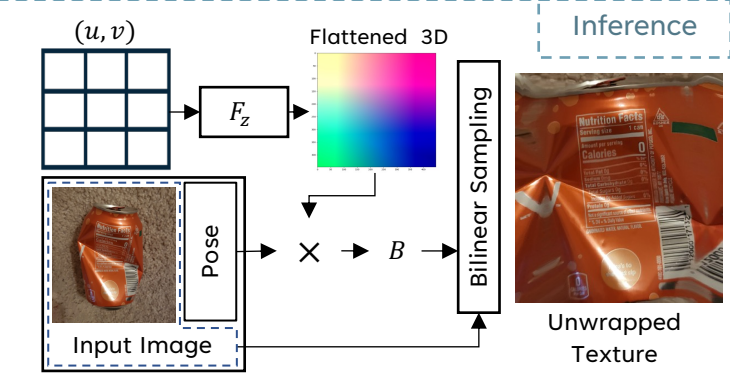
- Learn a **surface parameterization for implicit neural representations** using multi-view images and a texture mapping prior.
- Proposed method can be effectively used for document unwarping task by learning a prior for texture mapping on the document shape.
- We show **superior results in unwarping and texture editing** tasks:
 - Better (+25%) and stable local distortion (LD), across different views.
 - Better (+25%) OCR Performance.
 - Better than NeuTex [3], a method for texture editing with NeRFs.

Method	Task		
	3D recon.	View interp.	Texture unwrap/edit
NeRF	✓	✓	✗
IDR [1]	✓	✓	✗
Ours	✓	✓	✓

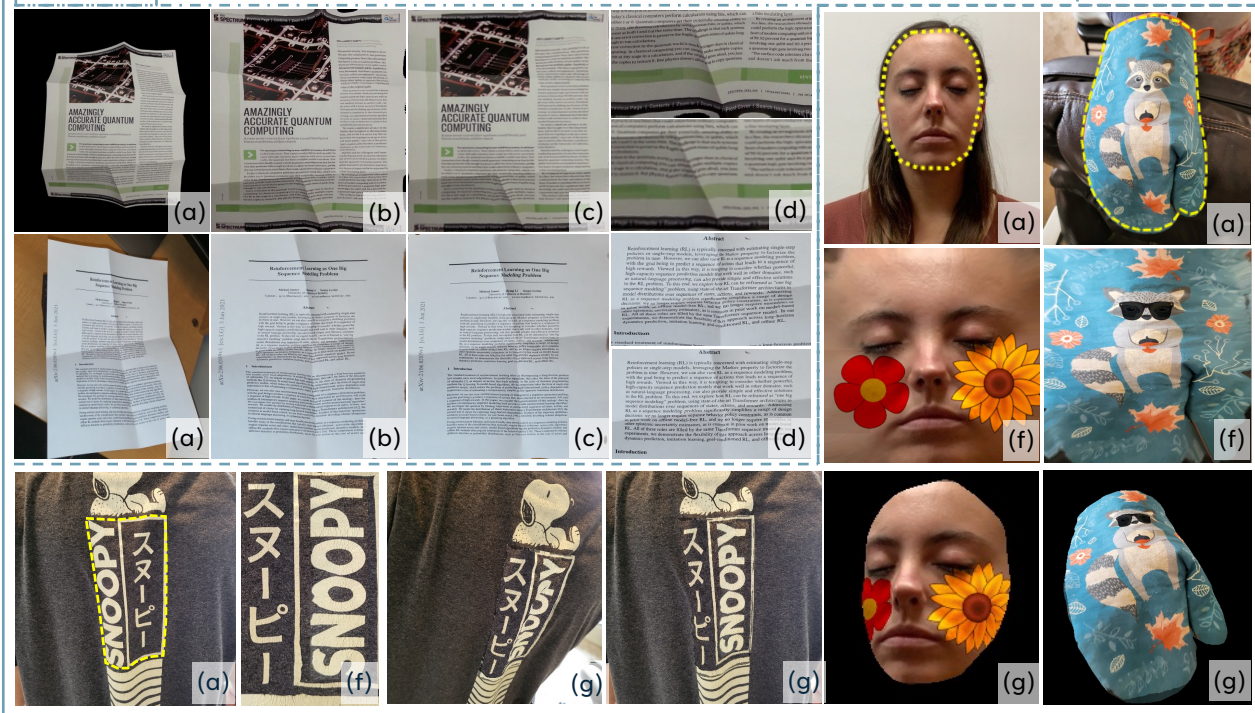
Proposed Method: Iso-UVField



- Modified IDR [1] rendering:**
 - $C_p = A(t_p, z_p, v_p, n_p, g_p)$
- Forward Network (3D to UV):**
 - $F_{uv}: z \rightarrow t$
 - Prior learned from UV mapped meshes.
- Backward Network (UV to 3D):**
 - $F_z: t \rightarrow z$
 - Scaled Isometry: $J^T J = \beta I$ where (J) is the Jacobian of F_z .



Experimental Results



(a) Input (b) DewarpNet [2] (c) Proposed (d) Zoomed (f) Edited texture (g) Different views

Acknowledgements: This work was done when Ke Ma was at Stony Brook University. This work was partially supported by the Partner University Fund, the SUNY2020 ITSC, the FRA project "Deep Learning for Large-Scale Roll Defect Inspection" and gifts from Adobe and Amazon AI.

References: 1. Yariv, L., Kasten, Y., Moran, D., Galun, M., Atzmon, M., Ronen, B., Lipman, Y.: Multiview neural surface reconstruction by disentangling geometry and appearance. NeurIPS, 2020. 2. Sagnik Das, Ke Ma, Zhixin Shu, Dimitris Samaras, and Roy Shikrot. DewarpNet: Single-image document unwarping with stacked 3D and 2D regression networks. ICCV, 2019. 3. Xiang, F., Xu, Z., Hasan, M., Hold-Geoffroy, Y., Sunkavalli, K., Su, H.: NeuTex: Neural texture mapping for volumetric neural rendering. CVPR, 2021.