InstaFlow: One Step is Enough For High-Quality Diffusion-Based Text-to-Image Generation

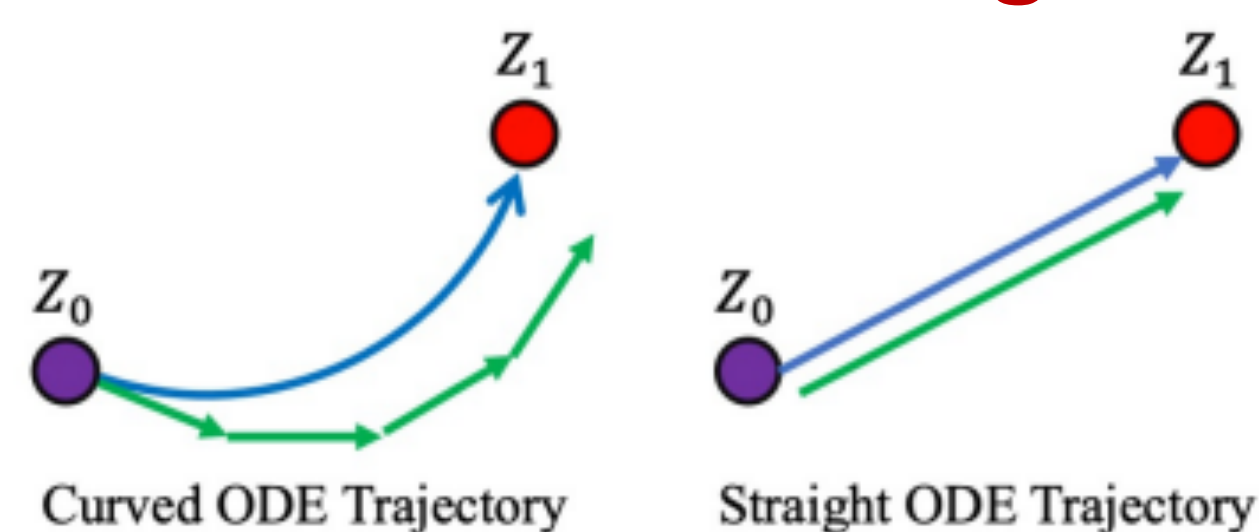Xingchao Liu[1], Xiwen Zhang[2], Jianzhu Ma[2], Jian Peng[2], Qiang Liu[1]
[1]UT Austin [2]Helixon Research

Rectified Flow Brings One-Step Stable Diffusion With Supervised Learning Only
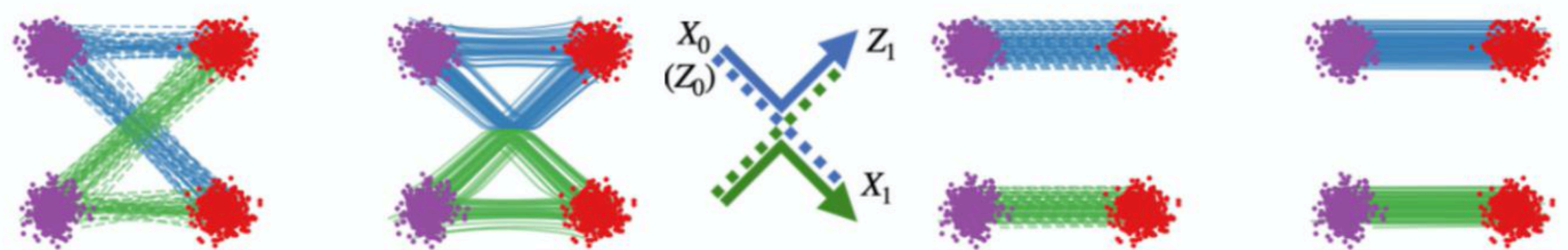
Rectified Flow:
Learn straight trajectories!

Curved ODE Trajectory   Straight ODE Trajectory

Straight = Fast

ReFlow:
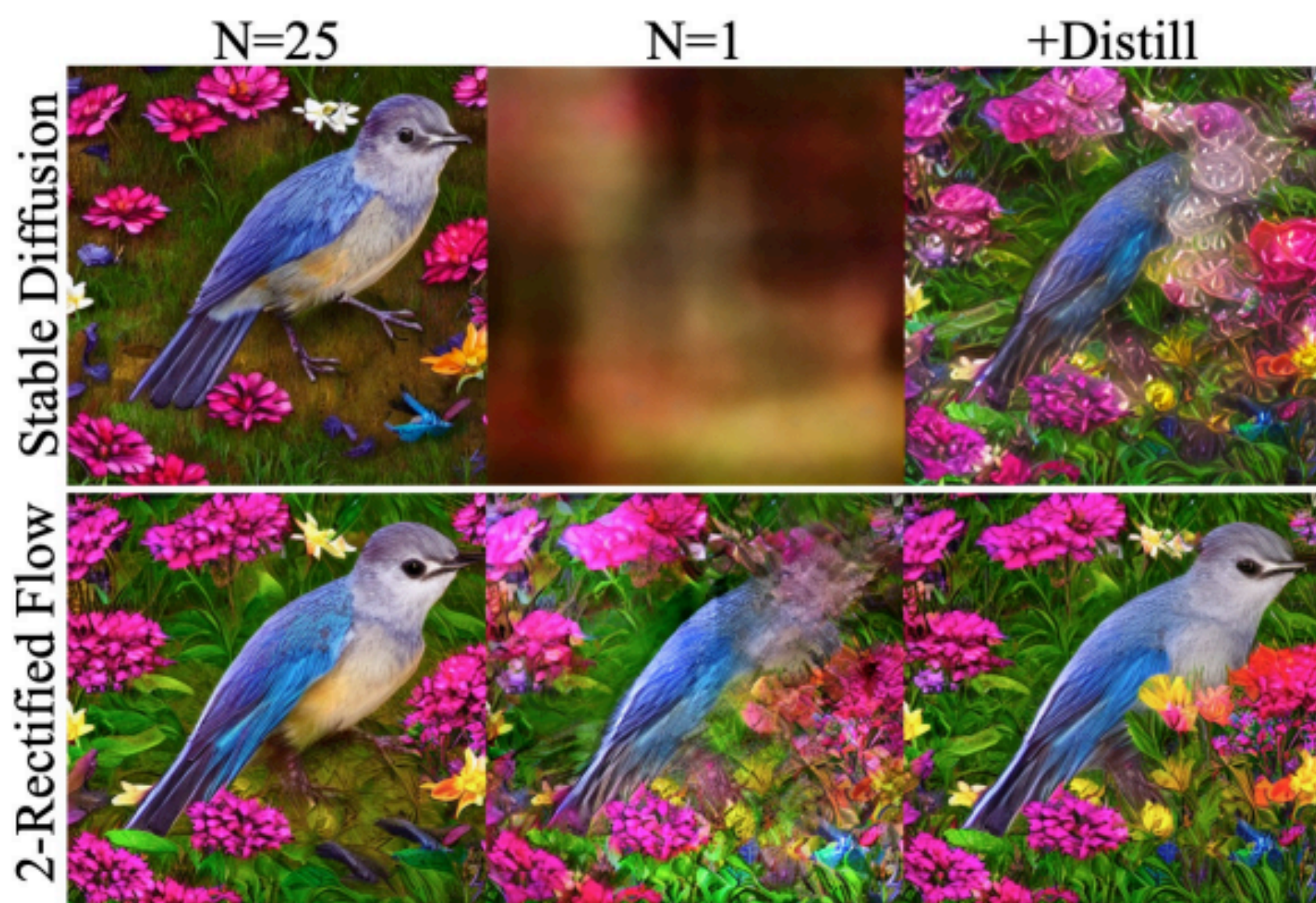**An Implicit Regularization on Probability Flows!**

(a) Linear interpolation $X_t = tX_1 + (1-t)X_0$

(b) Rectified flow Z_t induced by (X_0, X_1)

(c) Linear interpolation $Z_t = tZ_1 + (1-t)Z_0$

(d) Rectified flow Z induced by (Z_0, Z_1)

N=25   N=1   +Distill

Stable Diffusion

2-Rectified Flow

Method	Time	FID
SD (25)	0.9s	22.8
2-RF (25)	0.9s	**22.1**
PD (1)	0.09s	37.2
SD+D (1)	0.09s	40.9
2-RF (1)	0.09s	68.3
2-RF+D (1)	0.09s	**31.0**

Scale-up:
Data (LAION) + Model (SD U-Net) + Training Time (199 A100 GPU days)

One-Step Text-to-Image

One-Step ControlNet

Original   Stormtrooper   Albert Einstein   Roman sculpture   Medieval knight

Condition: Pose   + Van Gogh style