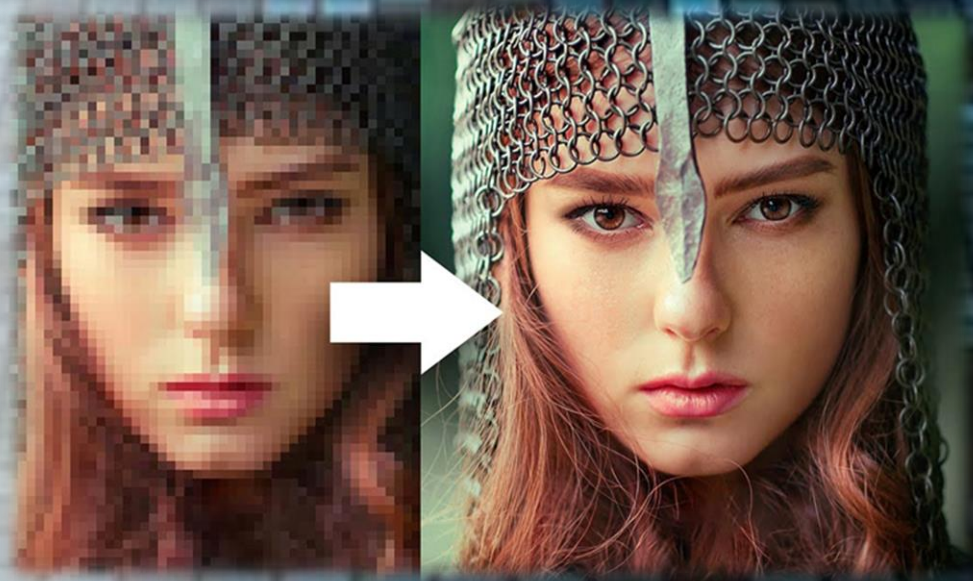
BRAUDE
College of Engineering, karmiel

Image Enhancement with Super-Resolution and Controlled Noise



24-1-R-12

Students: Liza Shvachka

Avishai Hershkovitz

Supervisor: Dr. Renata Avros

Advisor: Prof. Zeev Volkovich

Introduction the problem

- Existing models rely on clean images for restoration, which are sometimes unavailable.
- Traditional models require deep understanding.
- Dealing with the real world where images are varied, including different exposure levels.

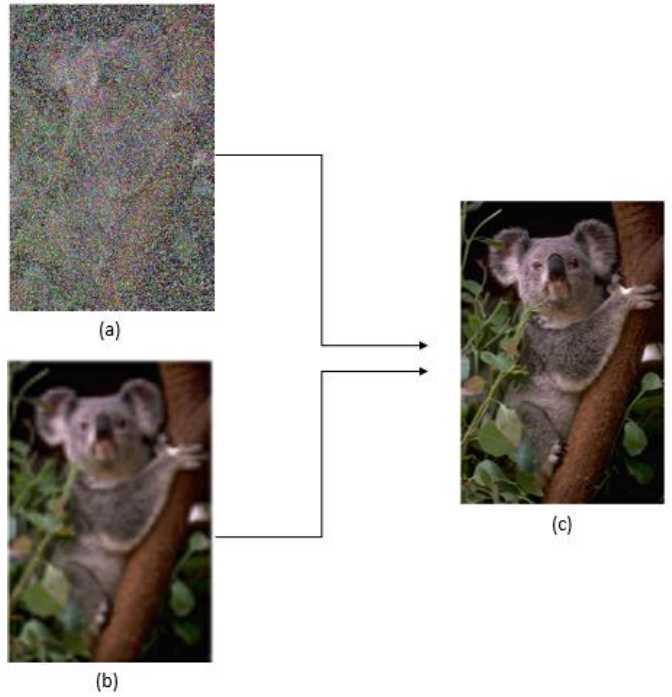
Importance of Image Restoration

Image is a visual representation capturing scenes, and objects, essential for conveying ideas and experiences.

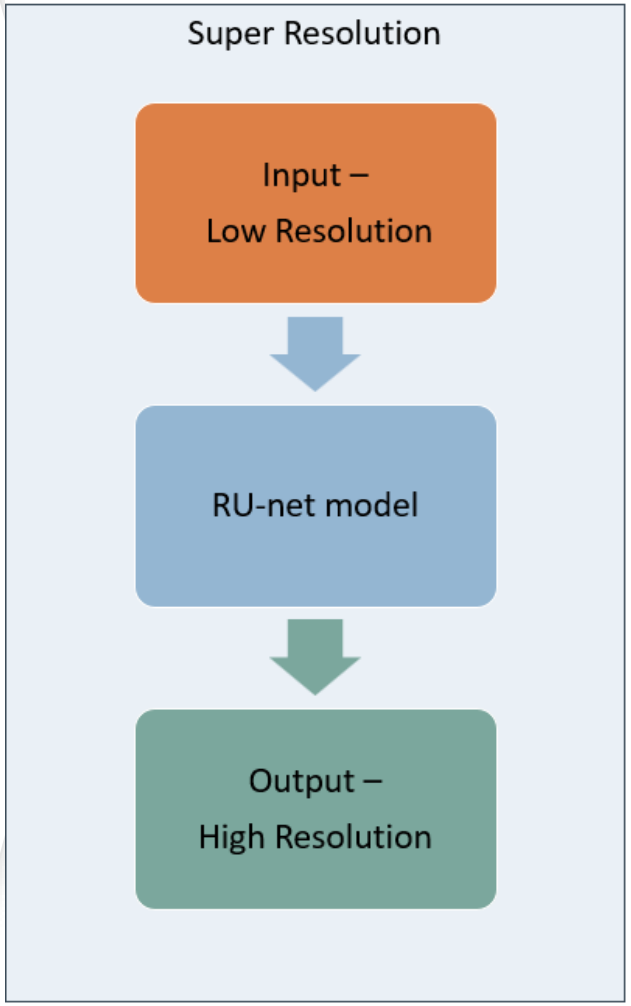
- Enhance clarity, detail, and overall quality.
- Improve visual understanding and interpretation.
- Correct imperfections for better usability.

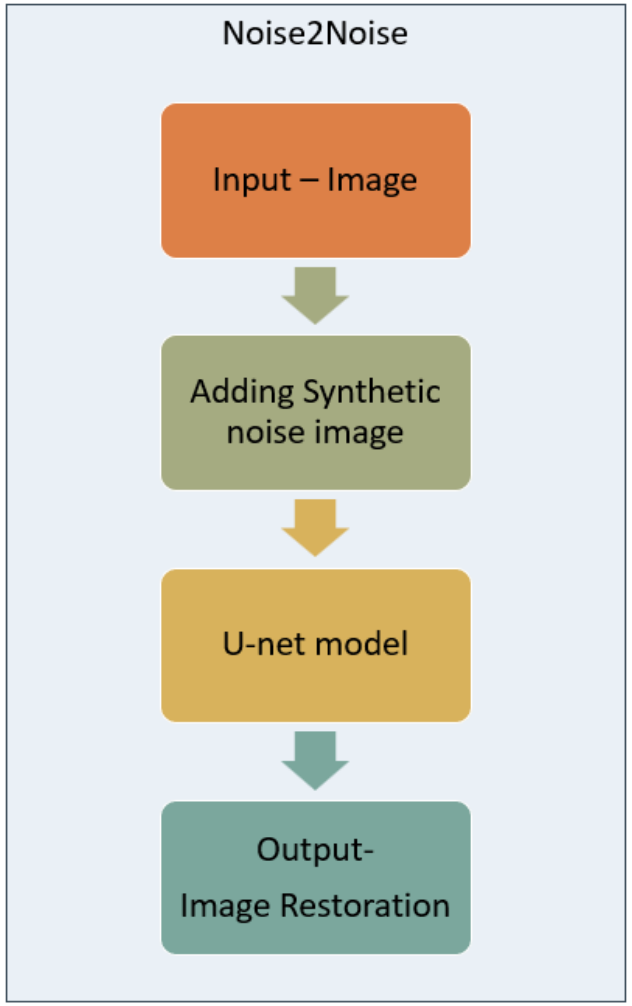
Suggested Solution

- Utilize Deep learning model Noise2Noise employing U-net.
- Restoring images based only on corrupted images.
- Implement Super Resolution Deep learning model using RU-net.

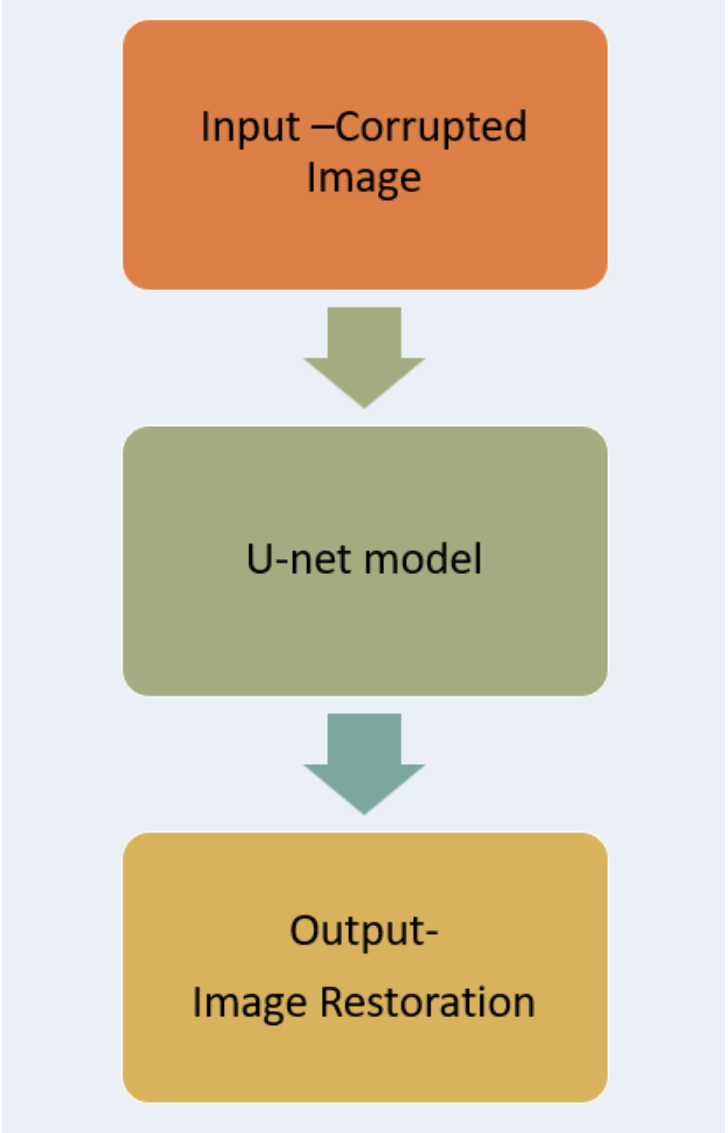


Flow Chart


Super Resolution
Input –
Low Resolution
RU-net model
Output –
High Resolution

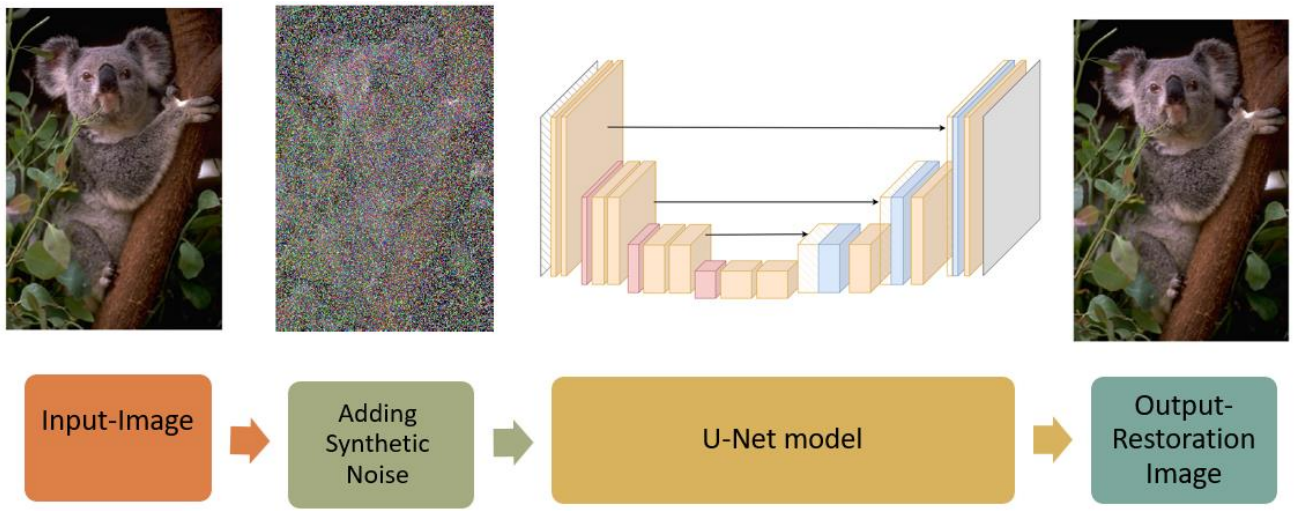

Noise2Noise
Input – Image
Adding Synthetic noise image
U-net model
Output-
Image Restoration

Noise2Noise

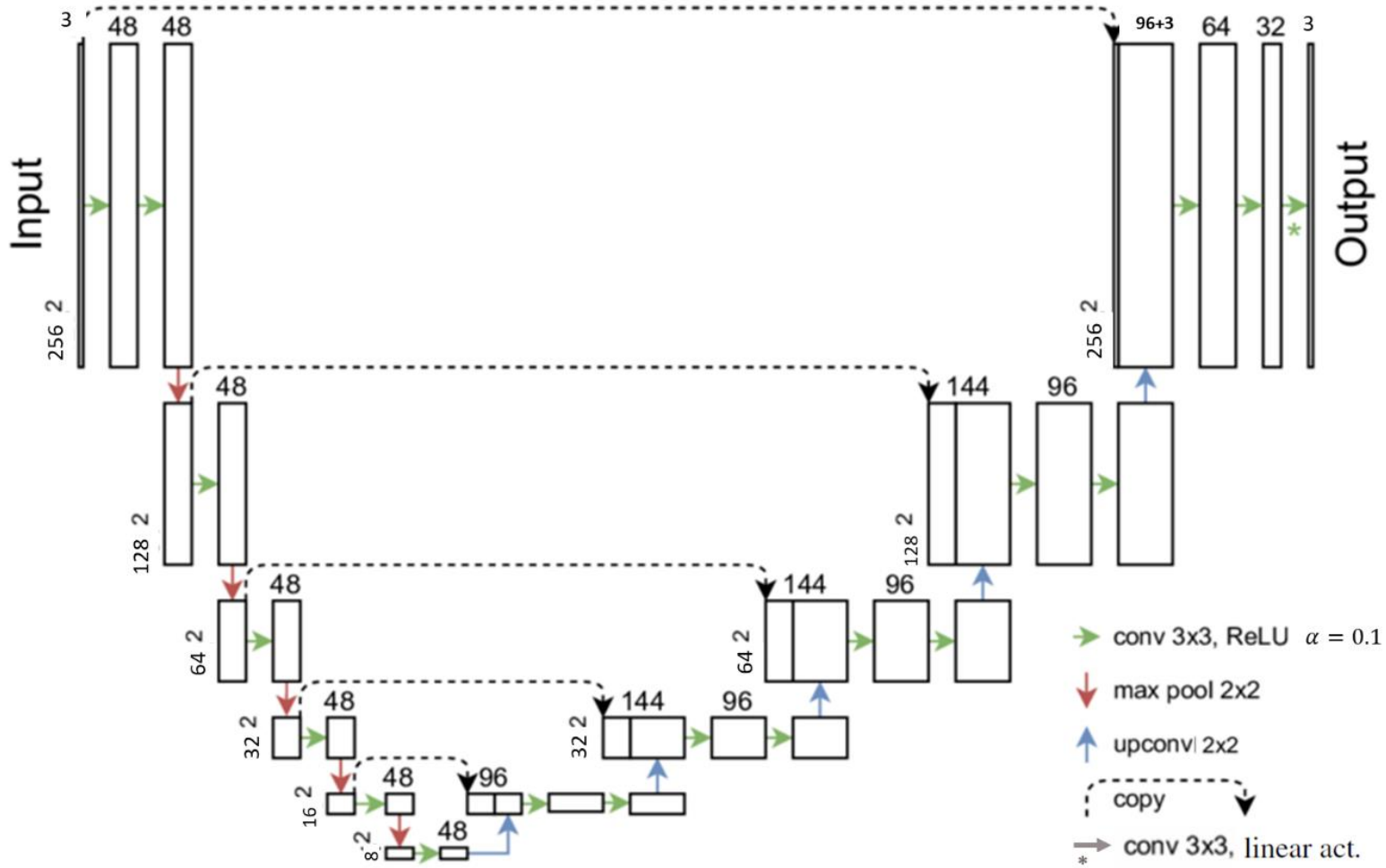


Noise2Noise ***Train Process***

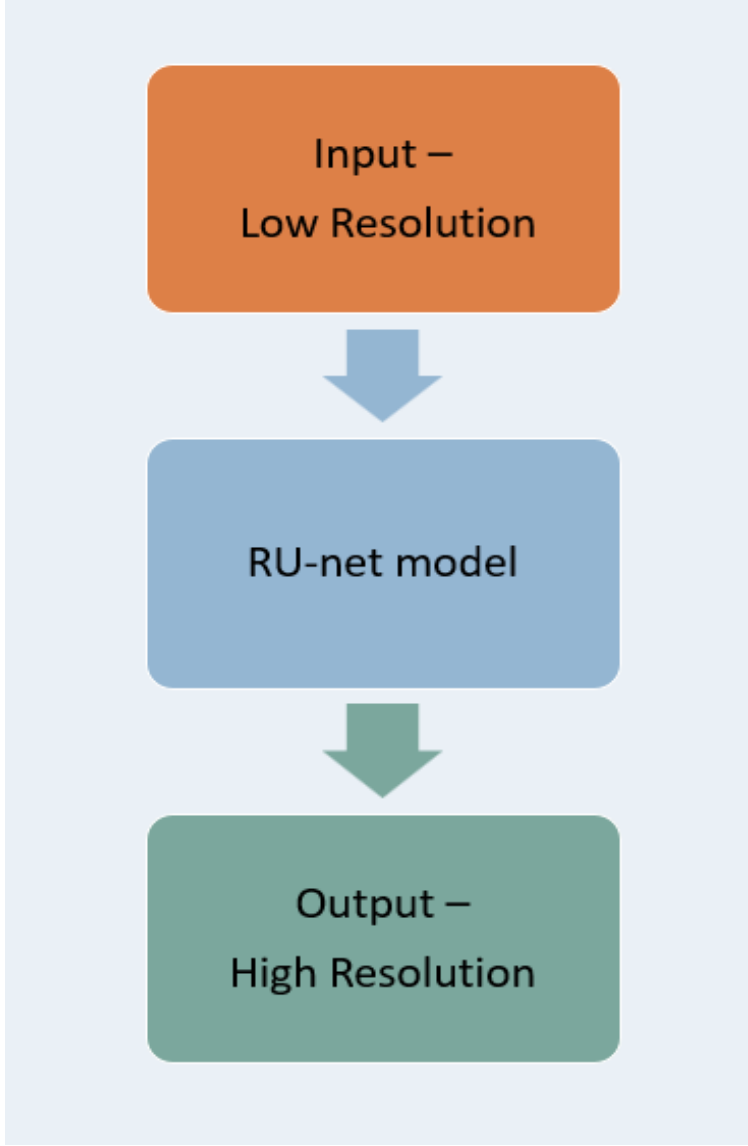
- Input: Image from various sources.
- Adding **Synthetic Noise**: Simulating real-world conditions.
- **U-net** Model Training: Iteratively mapping noisy to clean images.
- Output: Image Restoration with reduced noise.



Noise2Noise - *U-net* Phase

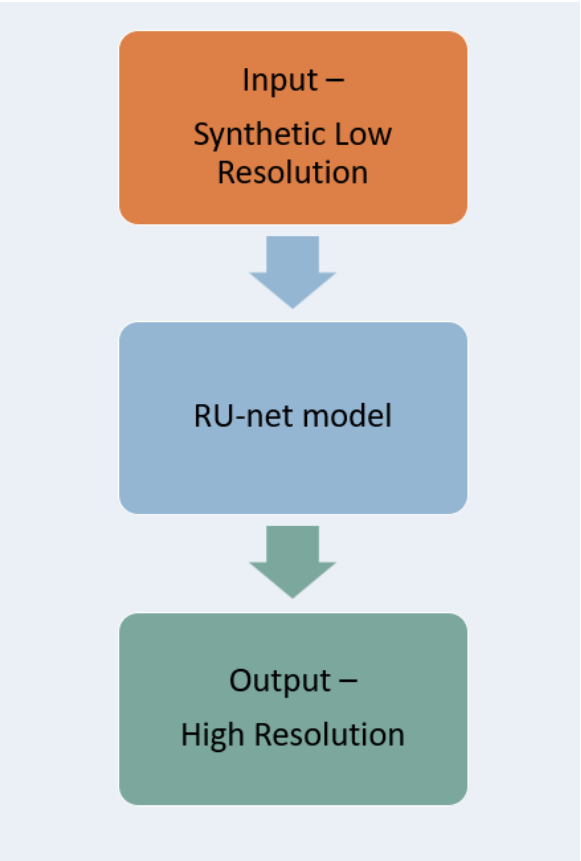


Super Resolution

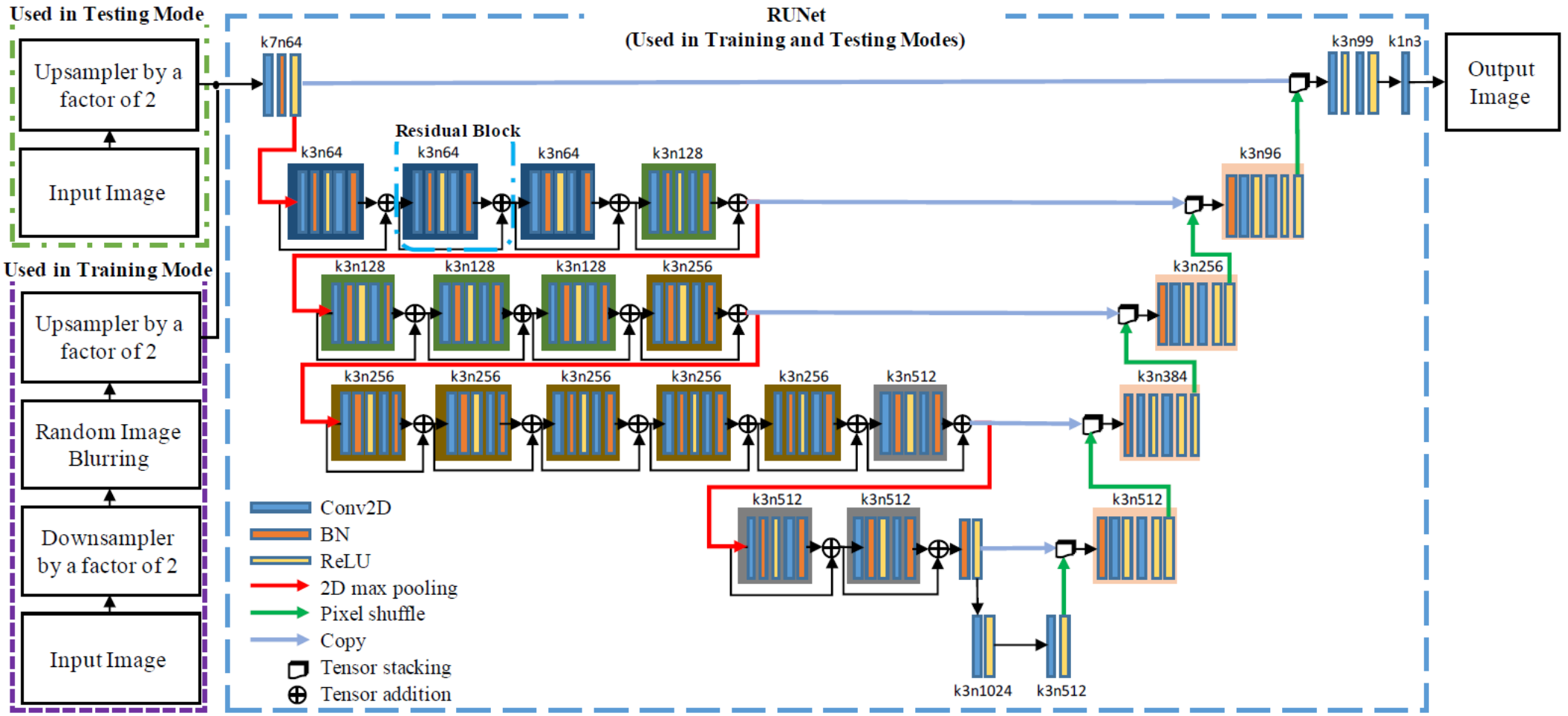


Super Resolution ***Train process***

- Synthetic **Low-Resolution** input: High-resolution images, down-sampled, blurred, up-sampled.
- **RU-net** Model: A robust U-net architecture.
- Output: High-resolution images and visual enhancement.



*Super-Resolution - **RU-net** Phase*



Expected Achievements

- Improve super-resolution and clean corrupted images techniques without explicit data.
- Compare the effectiveness of our models of reconstruction.
- Integrating both models into a unified model is planned.

Use Case

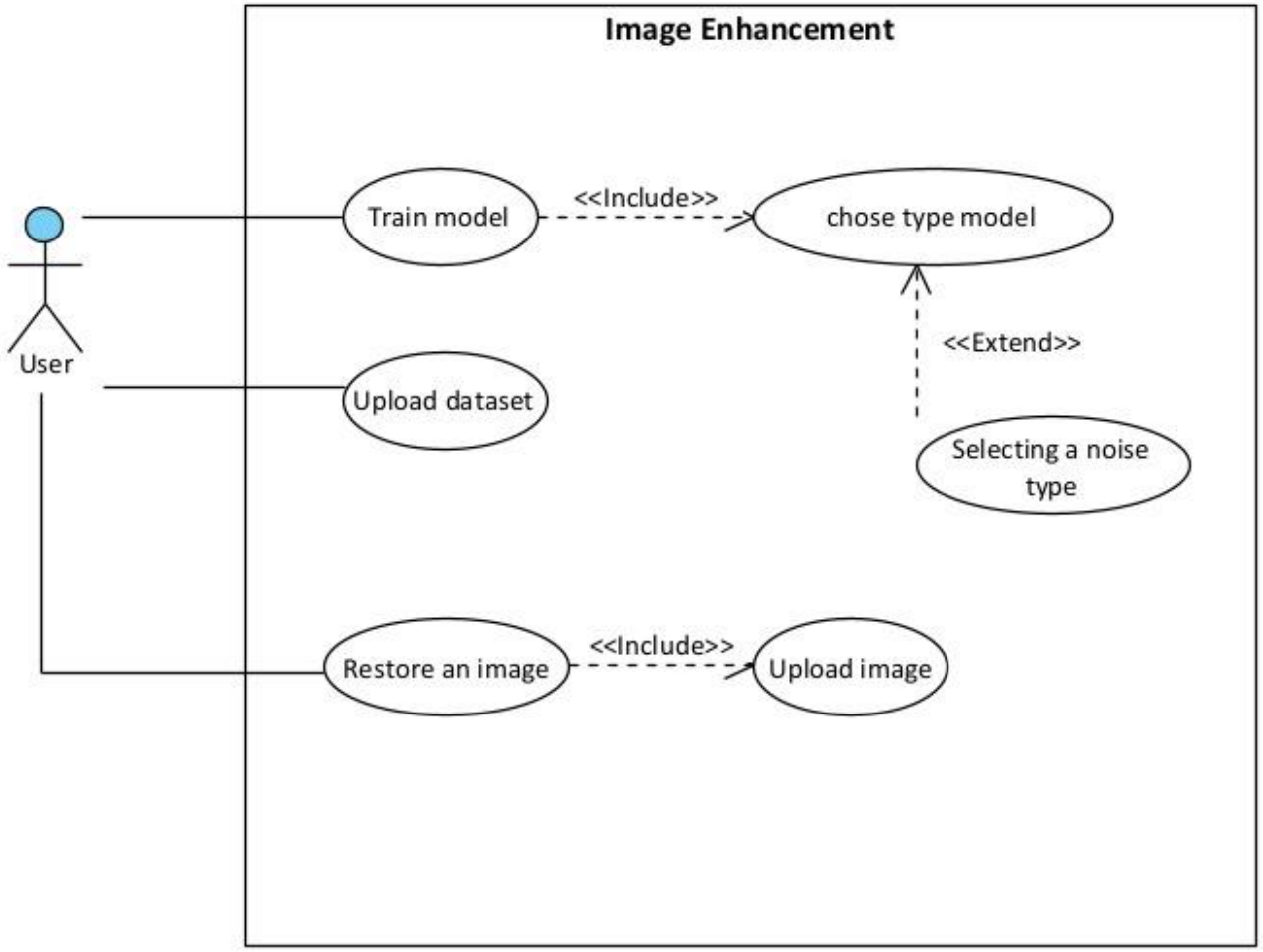
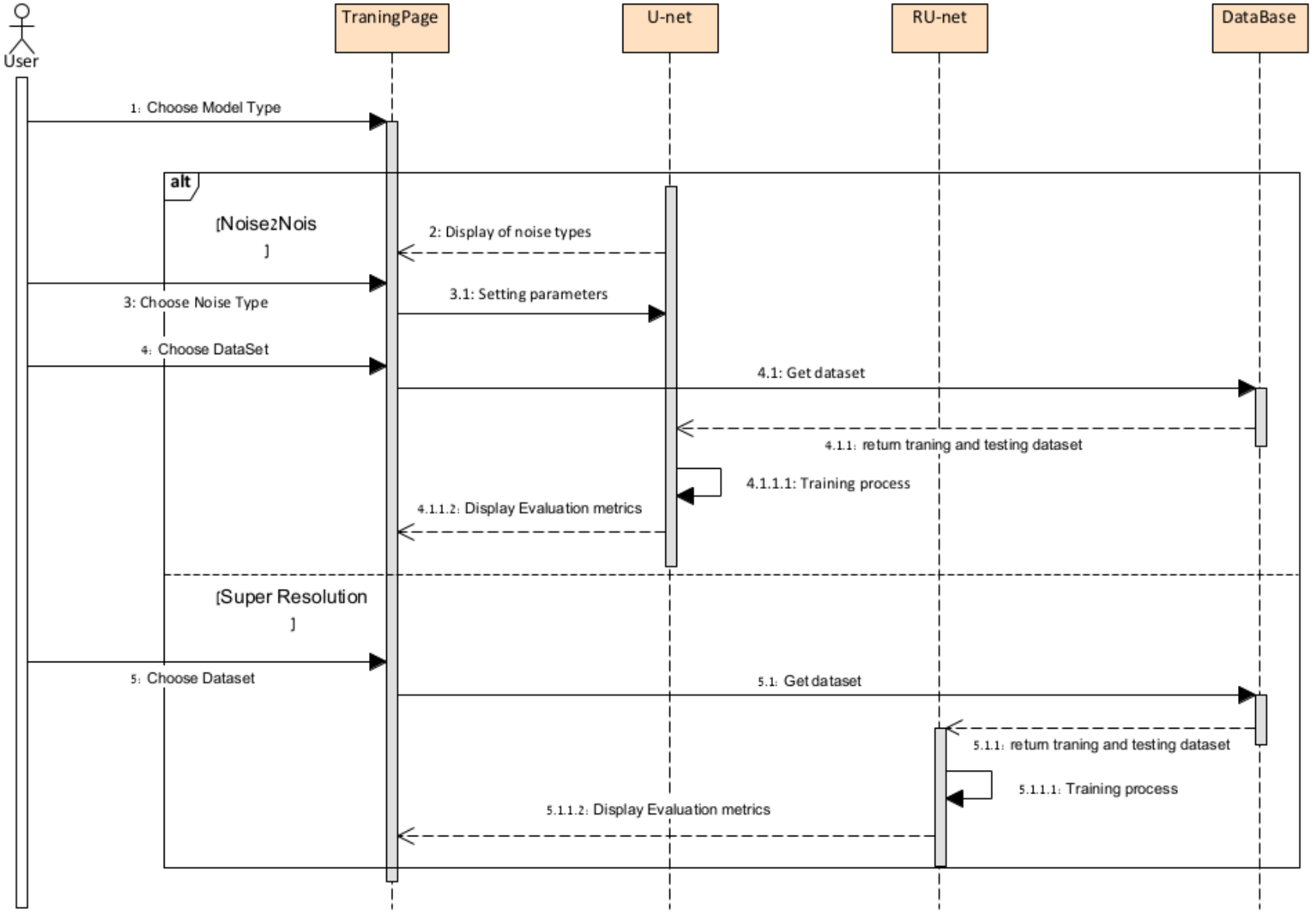


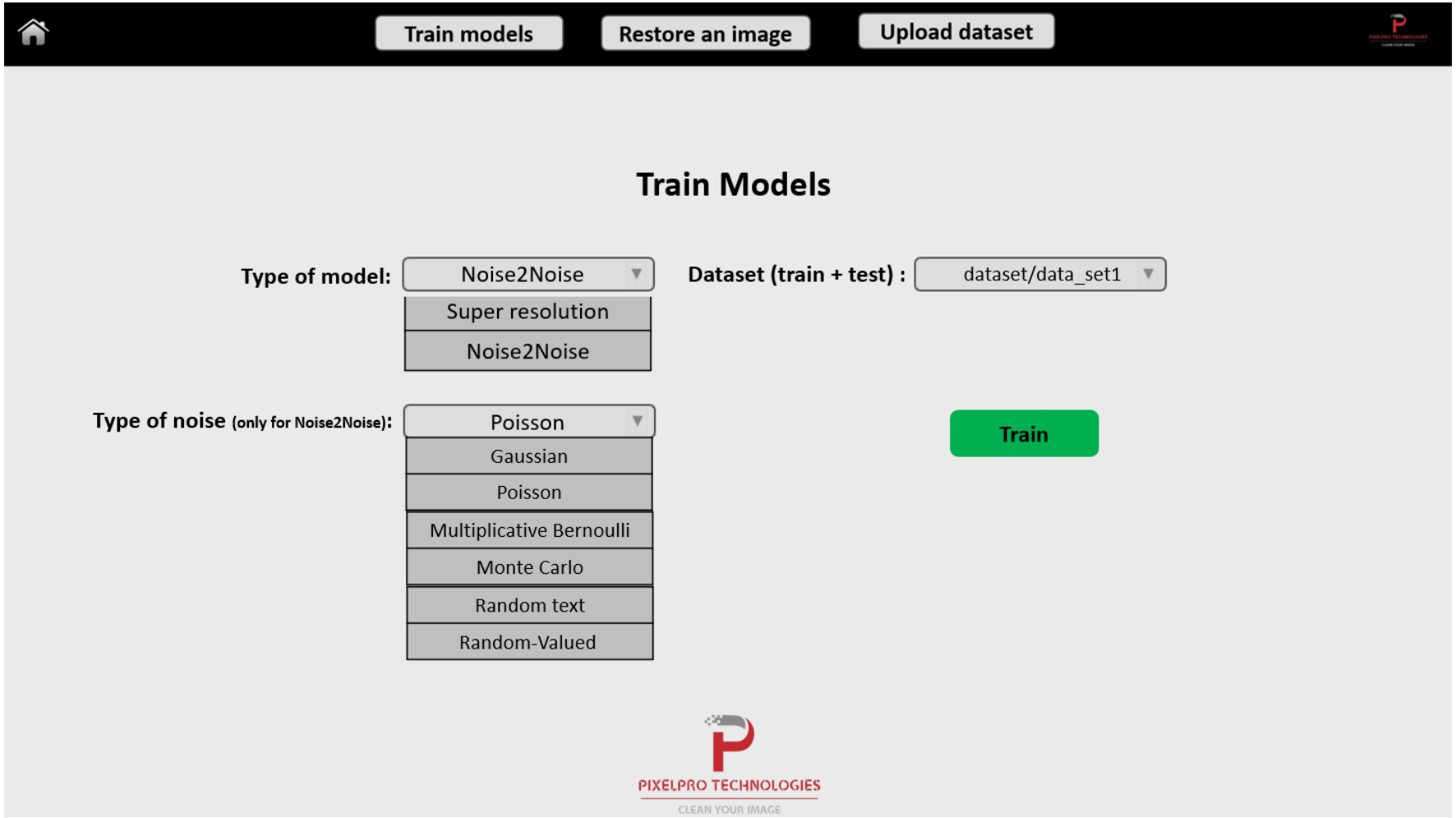
Image Enhancement
User
Train model
<<Include>>
chose type model
<<Extend>>
Selecting a noise type
Upload dataset
Restore an image
<<Include>>
Upload image

Sequence

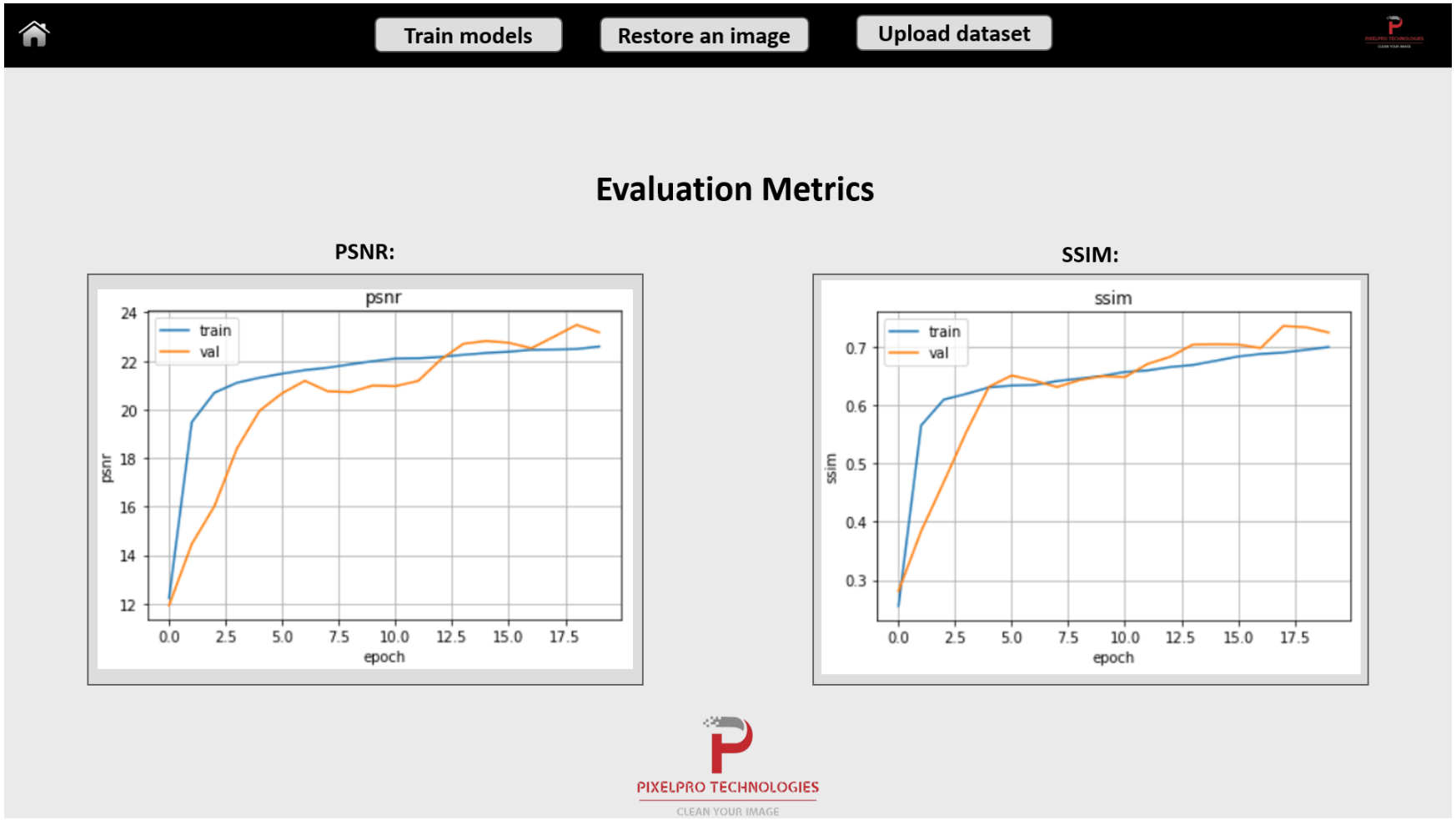

User
TraningPage
U-net
RU-net
DataBase
1: Choose Model Type
alt
[Noise2Nois
]
2: Display of noise types
3: Choose Noise Type
3.1: Setting parameters
4: Choose DataSet
4.1: Get dataset
4.1.1: return traning and testing dataset
4.1.1.1: Training process
4.1.1.2: Display Evaluation metrics
[Super Resolution
]
5: Choose Dataset
5.1: Get dataset
5.1.1: return traning and testing dataset
5.1.1.1: Training process
5.1.1.2: Display Evaluation metrics

GUI- Home page

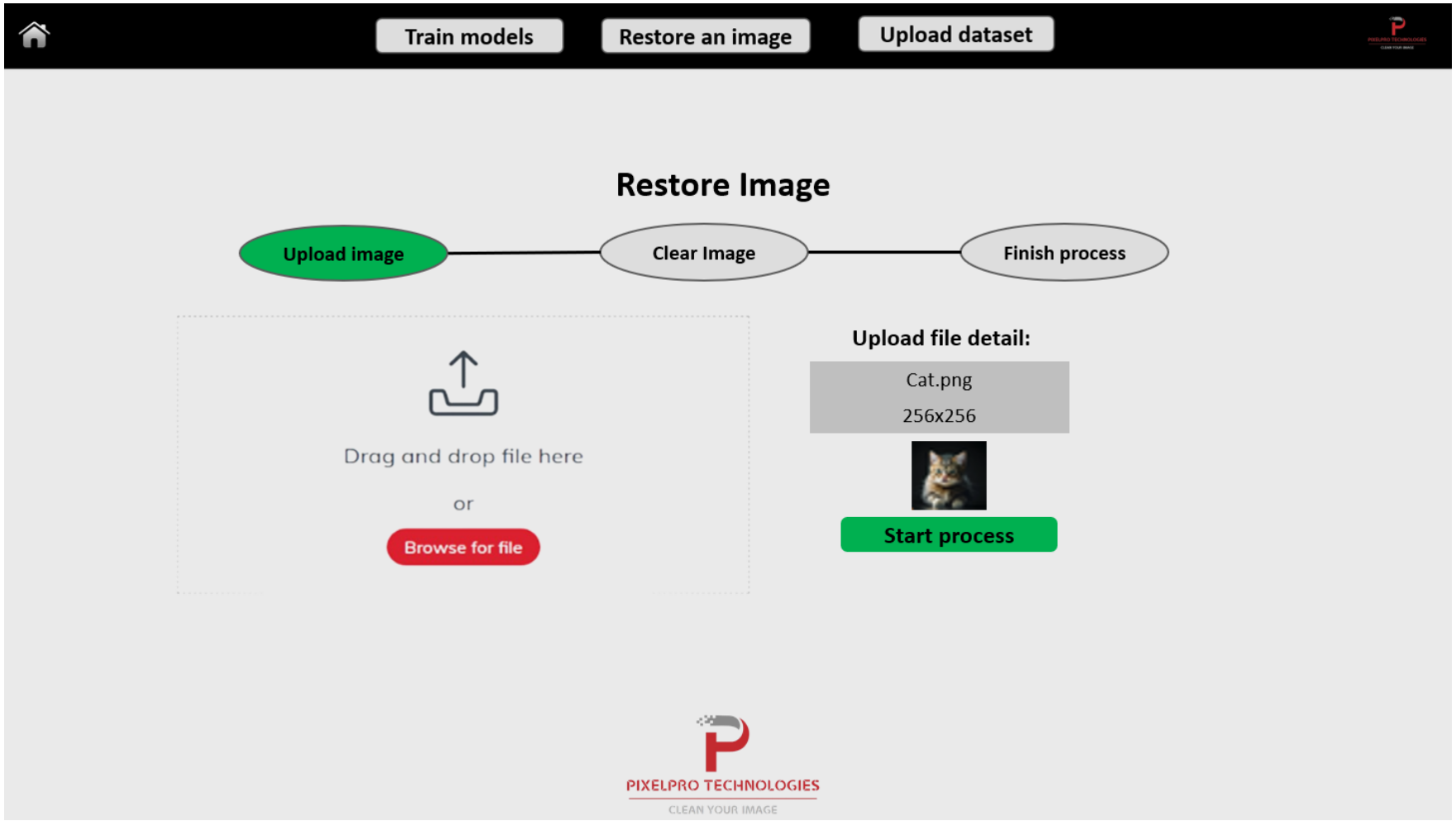
GUI- Train Models page



GUI- Evolution metrics of train page



GUI- Restore Image page



Main Test process

Module	Test description	Excepted result
Home page	Click 'Home' button in navbar menu	Open 'Home’ page
Home page	Click 'Train Models' in navbar menu	Open 'Train Models’ page
Home page	Click 'Restore an image' button in navbar menu	Open 'Restore an image’ page
Home page	Click 'Upload dataset' button in navbar menu	Open 'Upload dataset’ page
Train Models window>Type of Model	Click on combo box 'Type of model' and choose 'Super resolution'	Option ‘Super resolution' should be chosen.
Train Models window ->Type of model	Click on combo box 'Type of model' and choose 'Noise2Noise'	Option ‘Noise2Noise' should be chosen
Train Models window ->Type of model (Noise2Noise)->Type of noise	Click on combo box 'Type of noise' and choose 'Gaussian'	Option ‘Gaussian' should be chosen
Train Models window ->Train Process window	Click on 'Train' button	Open 'Train process' window with active training timer and current PSNR present window.
Restore an image window->Clear image	Click on button 'Start process'	Advance to step of Clear image processing with active precent of the clear
Restore an image window->Finish process	Click on button 'download'	Download the clean image to your computer
Upload dataset window	Click on 'Import dataset' button	An alert in green will pop up with message 'Dataset uploaded'

Thanks for your attention!

Liza Shvachka
Avishai Hershkovitz