Idea/Solution Details

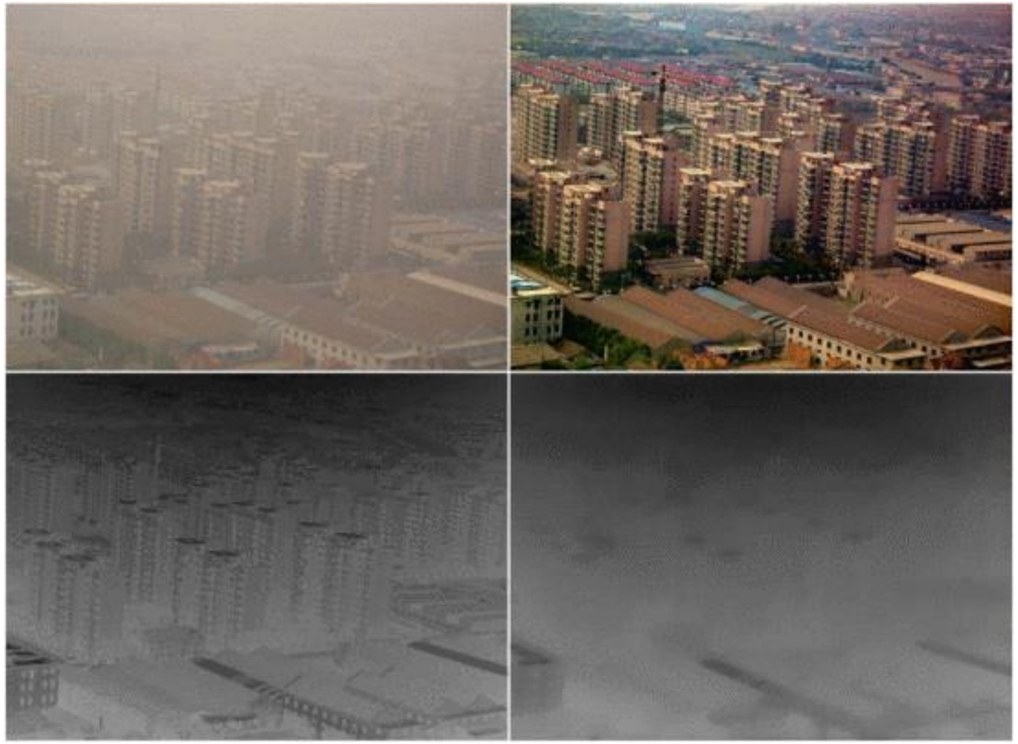
Idea:

- **Haze & Fog causes several Road and Plane accidents:** Survey By Times of INDIA Shows about **11000 people died** because of accidents met due to Fog/Haze during the year 2017 and the number keeps on increasing every year. Several Plane and Chopper crashes has been reported due to low visibility caused by Fog and Haze. In 2019 we lost Chief of Defence Staff, during a chopper crash caused by low visibility caused by haze. Another accident in which **234 people died** during an Indonesian Jet crash due to reduced visibility caused by Fog and Haze. Hence, we strive to develop an application that performs real time dehazing that reduces the chance of accident in foggy and hazy weather.

Our Solution :

- Images captured in foggy weather conditions often suffer from bad visibility. we propose an efficient regularization method to remove hazes from a single input image. Our method benefits much from an exploration on the inherent boundary constraint on the transmission function. This constraint, combined with a weighted L_1-norm based contextual regularization, is modeled into an optimization problem to estimate the unknown scene transmission. A quite efficient algorithm based on variable splitting is also presented to solve the problem. The proposed method requires only a few general assumptions and can restore a high-quality haze-free image with faithful colors and fine image details.
- To achieve real time dehazing we can use cloud server (TPUs) which can perform almost real time processing.

- The prototype LINK : [LINK]
  The prototype removes Haze and Fog and enhances quality of Videos/Images.



Tech stack/Dependencies :

OpenCV

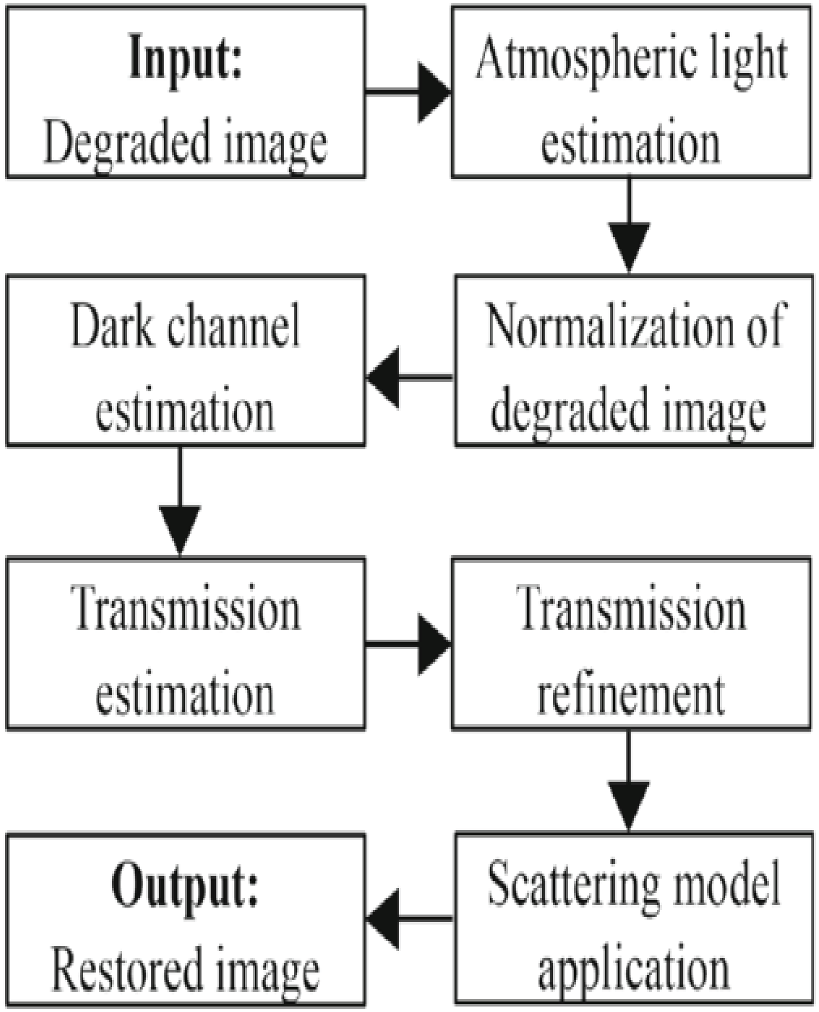
pillow

NumPy

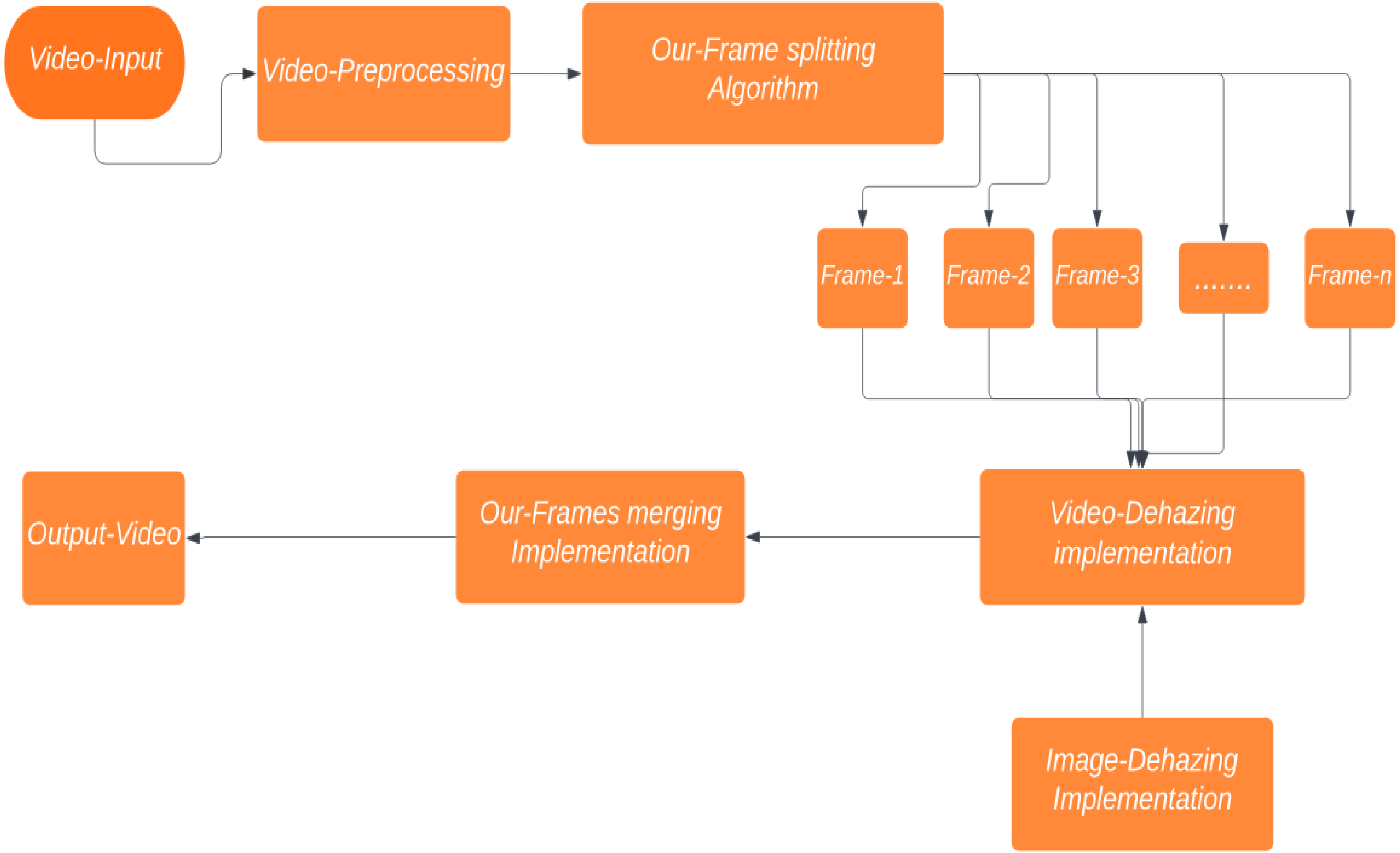
MoviePy

Idea/Approach Details

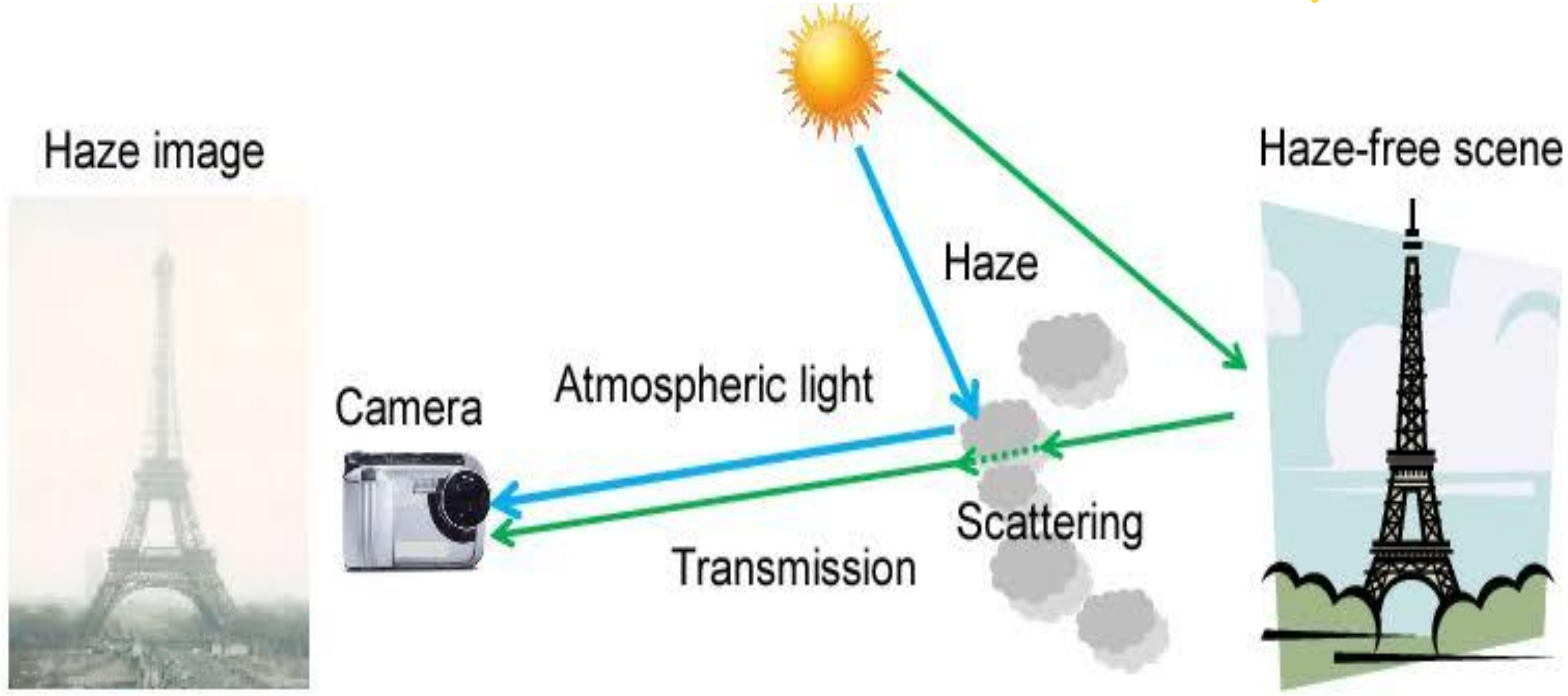
Image Processing Algorithm



Video Algorithm



Used Method: Boundary Constraint and Contextual Regularization



'ig. 1. An example illustration of haze optical model applied to a natural scenario with haze.

$$\mathbf{I}(x) = t(x)\mathbf{J}(x) + (1 - t(x))\mathbf{A}$$

Where,

I(x) - represents the observed hazy image.
J(x) - represents the scene radiance.
t(x) - represents the transmission map.
A - represents the global atmospheric light.

Dark channel prior

- min(r, g, b, local patch)
  - min(r, g, b)
  - min(local patch)

$$J^{dark}(\boldsymbol{x}) = min_{y\in\Omega(x)}\{min_{c\in\{r,G,B\}} J^c(\boldsymbol{y})\}$$

- J^c: color channel of $J(x)$
- J^{dark}: dark channel of $J(x)$

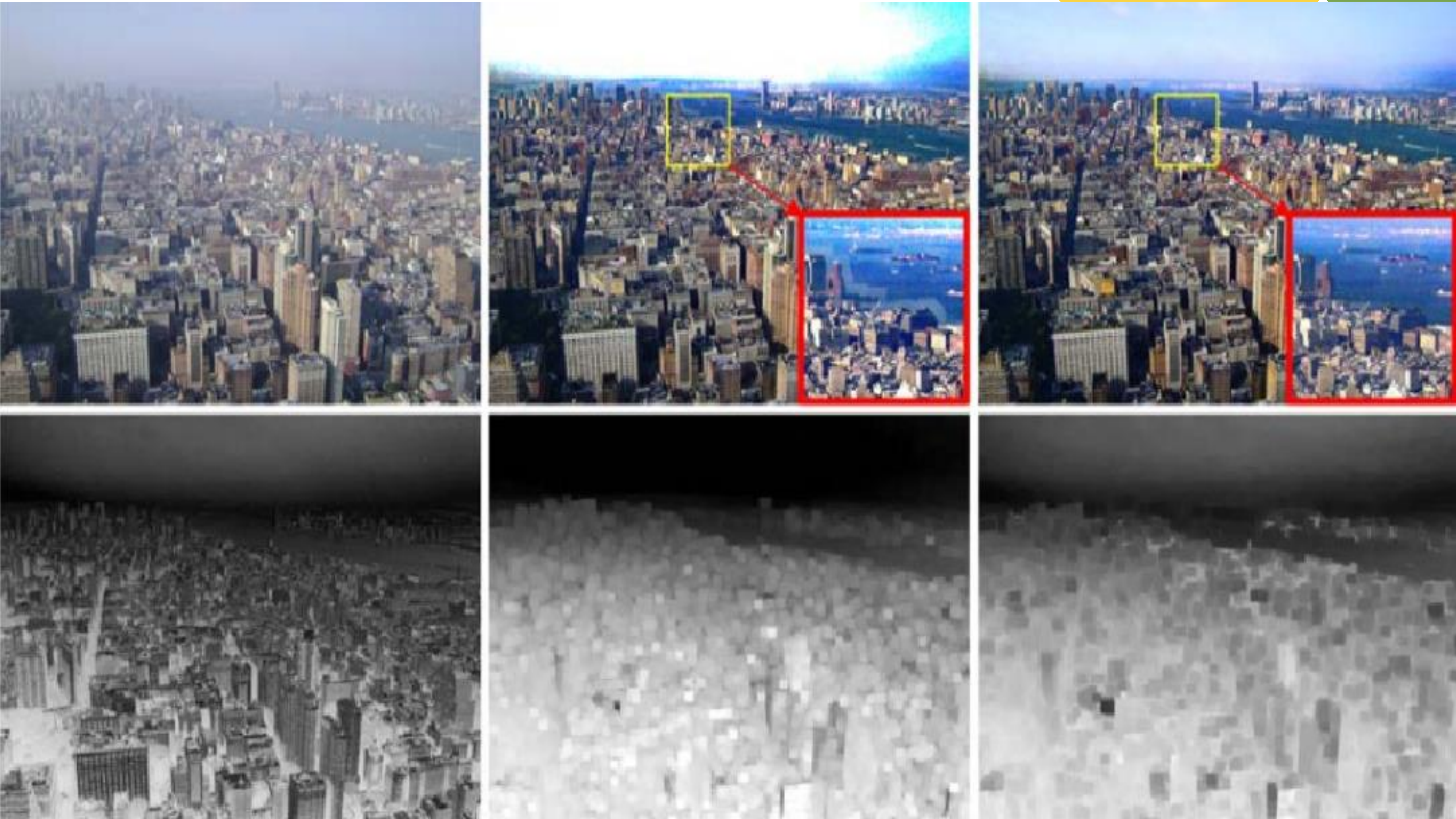
$$\tilde{t}(x) = \max_{y \in \omega_x} t_b(y)$$

Modified to

$$\hat{t}(x) = \min_{y \in \omega_x} \max_{z \in \omega_y} t_b(z)$$

WHY?

Bright pixels in the image often correspond to light sources in the scene, such as the bright sky or headlights of cars. These pixels emit high levels of light and can significantly influence the overall brightness of the image.



Weighted L1-norm based Contextual Regularization

$$W(x, y)\,(t(y) - t(x)) \approx 0.$$

W(x,y) must be small if the depth difference between x and y is large, and vice versa.

Integrating the weighted contextual constraints in the whole image domain leads to the following contextual regularization on t(x):

$$\int_{x\in\Omega}\int_{y\in\omega_x} W(x,y)\,|t(x)-t(y)|\,dxdy.$$

$$\frac{\lambda}{2}\|t-\hat{t}\|_2^2+\sum_{i\in I}\sum_{j\in\omega_i} w_{ij}\,|t_i-t_j|;$$

Sample outputs of our prototype