

Solar Orbiter Images Challenge

Group: Computer vision

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Workflow

Step 1: problem overview.

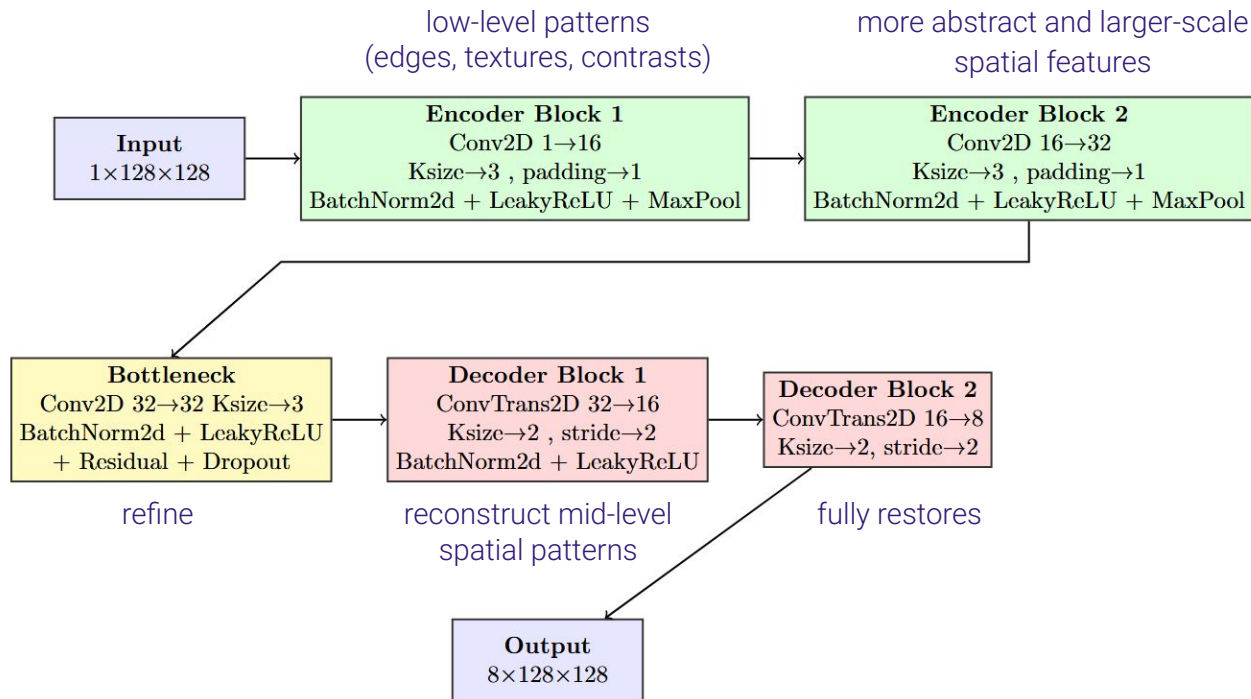
- Discussion of the task given.
- Data exploration (identifying input and output data).
- Identifying relevant DL type to use (relevant tutorials, prototype models, etc.).

Step 2: data preparation and model setup.

- Splitting into train and test data.
- Model architecture (next slide).
- Loss function: mean squared error (MSE).

Step 3: training, testing, evaluation, and hyperparameter tuning.

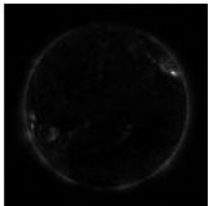
Model



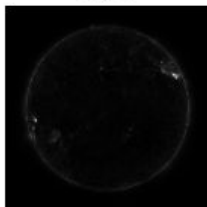
Results

Input

Target
Input



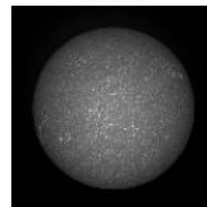
Target
Ch 0



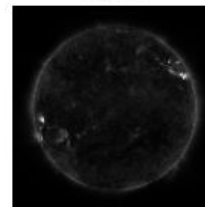
Target
Ch 1



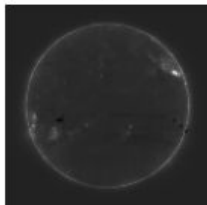
Target
Ch 2



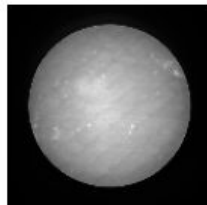
Target
Ch 3



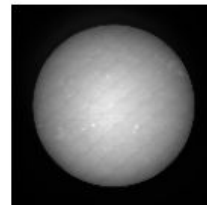
Pred
Ch 0



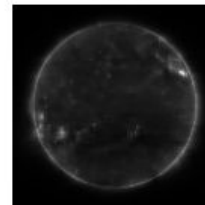
Pred
Ch 1



Pred
Ch 2



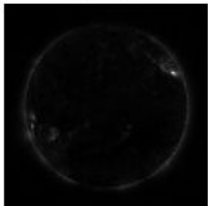
Pred
Ch 3



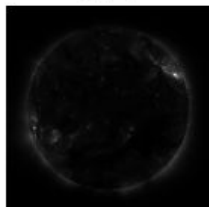
Results

Input

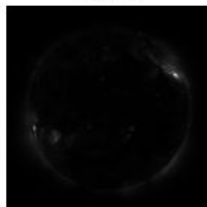
Target
Input



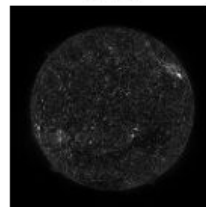
target
Ch 4



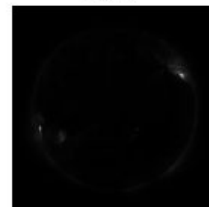
target
Ch 5



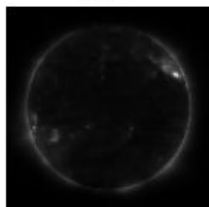
target
Ch 6



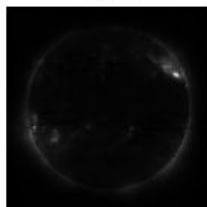
target
Ch 7



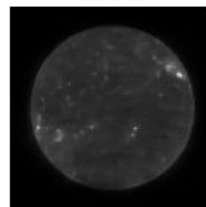
Pred
Ch 4



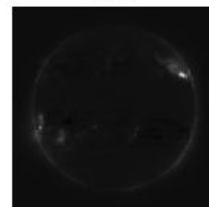
Pred
Ch 5



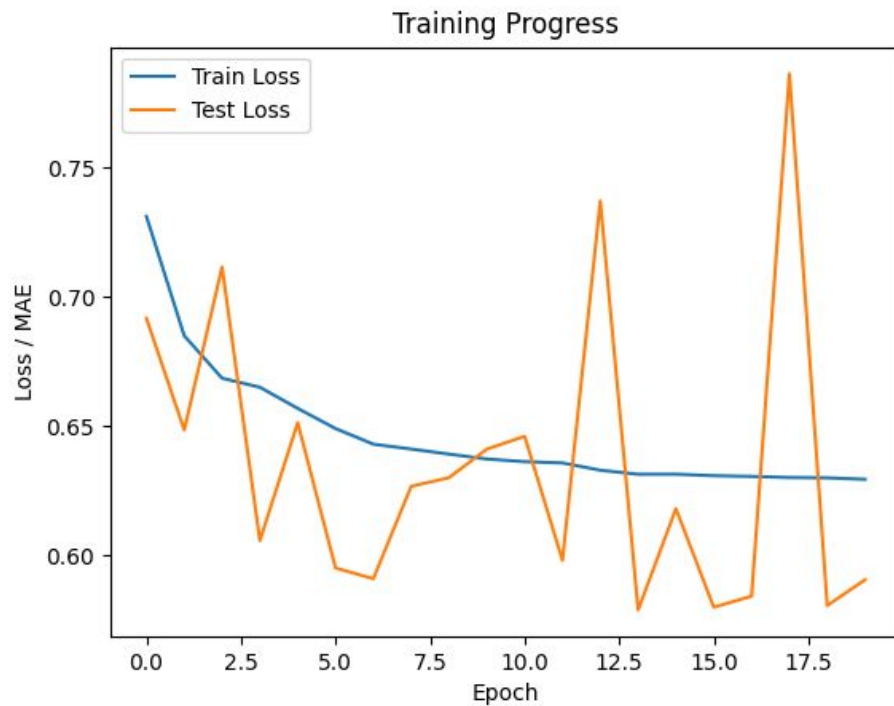
Pred
Ch 6



Pred
Ch 7



Results



Environmental Impact



Environmental Impact



Environmental Impact

- **Duration: ~10 minutes** (606 seconds)
- **Device:** Apple M1 (8-core, 16GB RAM)

Energy Consumption:

- Total Energy: **1.35 Wh**
- CPU Energy: **0.84 Wh**
- RAM Energy: **0.51 Wh**
- GPU Energy: **0.00 Wh** (no GPU used)

CO₂ Emissions:

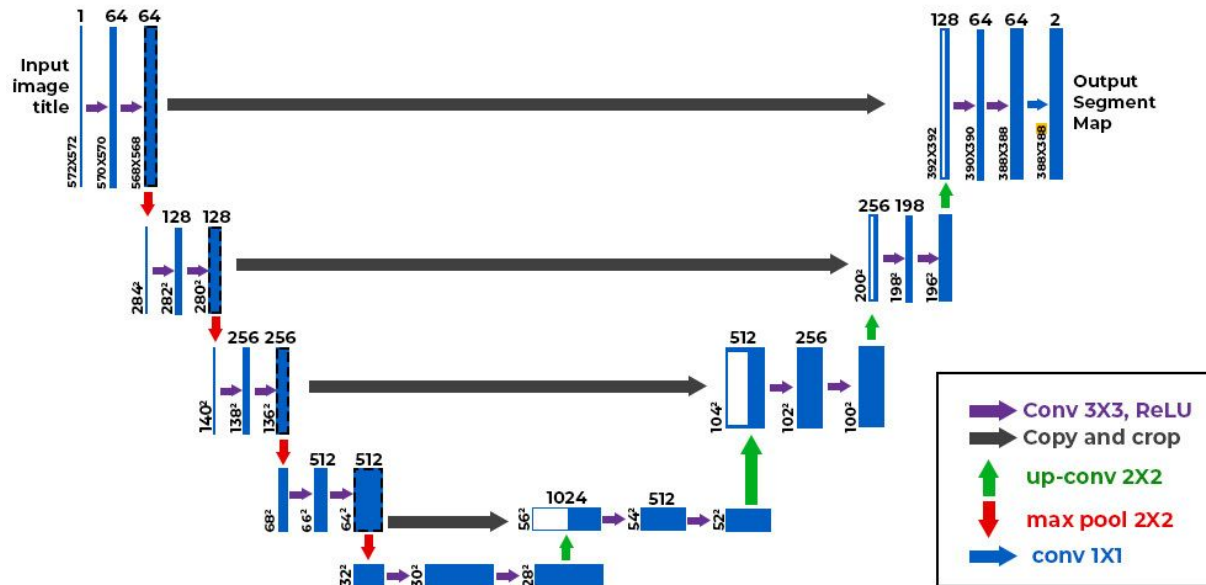
- **0.00051 kg CO₂eq** $\approx 0.5 \text{ g CO}_2$
- – Sending ~4 emails 
- – Driving ~3 meters in a petrol car 

Further Improvement

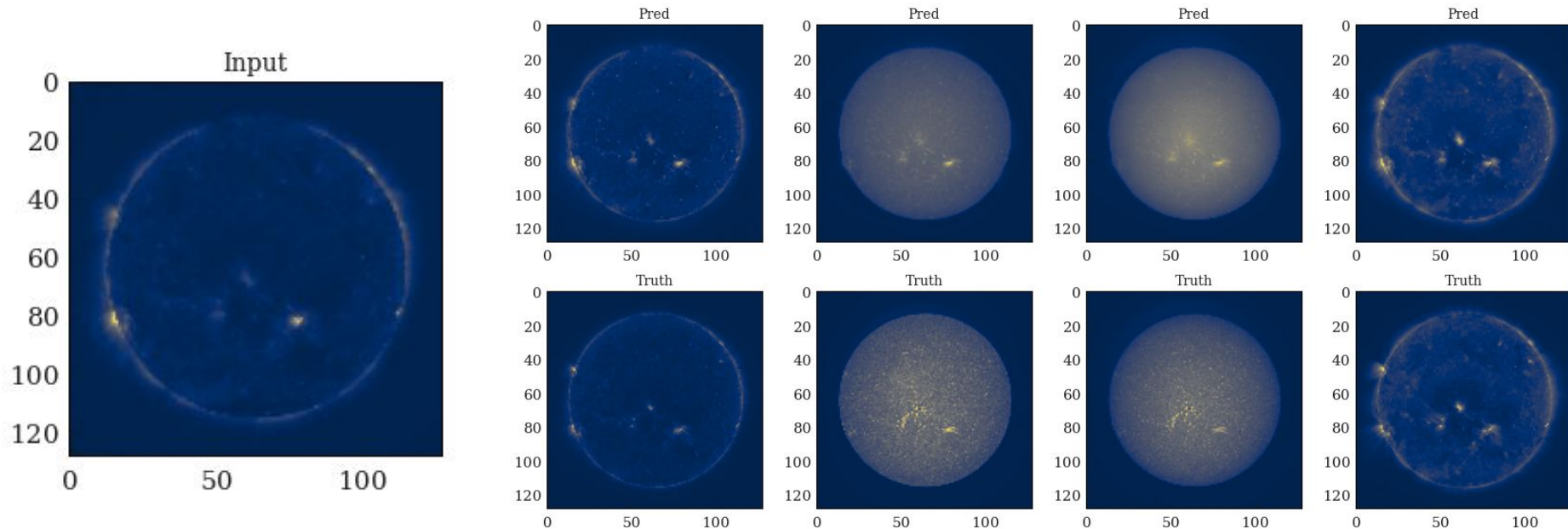
- Images from different filters are correlated
- The input image has different shared features with target images.
- We require a mechanism to separate different features and preserve information

Use UNet!

UNet Architecture



UNet Results, After 4 epochs only!!



Appendix

Model summary

Layer (type)	Output Shape	Param #
Conv2d-1	[32, 16, 128, 128]	160
BatchNorm2d-2	[32, 16, 128, 128]	32
LeakyReLU-3	[32, 16, 128, 128]	0
MaxPool2d-4	[32, 16, 64, 64]	0
Conv2d-5	[32, 32, 64, 64]	4,640
BatchNorm2d-6	[32, 32, 64, 64]	64
LeakyReLU-7	[32, 32, 64, 64]	0
MaxPool2d-8	[32, 32, 32, 32]	0
Conv2d-9	[32, 32, 32, 32]	9,248
BatchNorm2d-10	[32, 32, 32, 32]	64
Dropout-11	[32, 32, 32, 32]	0
ConvTranspose2d-12	[32, 16, 64, 64]	2,064
BatchNorm2d-13	[32, 16, 64, 64]	32
LeakyReLU-14	[32, 16, 64, 64]	0
ConvTranspose2d-15	[32, 8, 128, 128]	520
Total params: 16,824		
Trainable params: 16,824		
Non-trainable params: 0		
Input size (MB): 2.00		
Forward/backward pass size (MB): 416.00		
Params size (MB): 0.06		
Estimated Total Size (MB): 418.06		