

RECOVERING MISSING DATA FROM HUMAN BODY IMAGES

MAI - Master in Artificial Intelligence



UNIVERSITAT POLITÈCNICA
DE CATALUNYA
BARCELONATECH



UNIVERSITAT
ROVIRA I VIRGILI



UNIVERSITAT DE
BARCELONA

By: Martí Soler Planas

Advisor: Sergio Escalera





INTRODUCTION



PROBLEM

- Semantic Knowledge
- Images of Humans
- **Plausible** Reconstruction



OUTLINE

- **Introduction**
 - Problem
 - Outline
- **Dataset**
 - Sources
 - Joints
 - Masks
- **Metrics**
 - DSSIM, MSE
 - WNJD
- **Analyzed Methods**
 - Related work
 - Context Encoders
 - Semantic Inpainting
 - PatchBased
- **Results**
 - Qualitative
 - Quantitative
 - Model
- **Problems and discussion**
 - Infighting between objectives
 - Instability
 - Onion
- **Competition**
- **Conclusions**
 - future Work





Dataset

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Sources

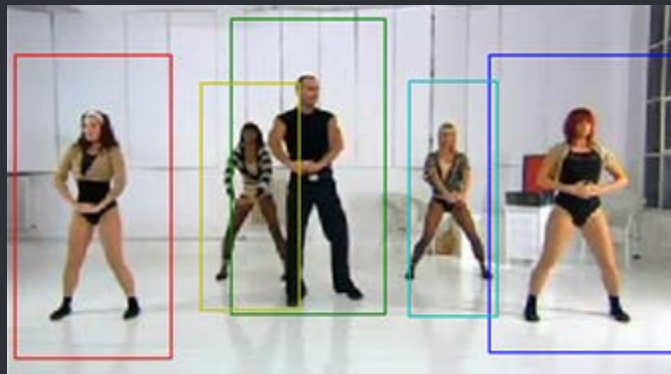
41076 Images

Big Variance

Name	#Images Used	Cropped
MPII Human Pose Dataset [Andriluka et al. (2014)]	26571	Yes
Leeds Sports Pose Dataset [Johnson and Everingham (2010)]	2000	No
Synchronic Activities Stickmen V [Eichner and Ferrari (2012)]	1128	Yes
Short BBC Pose [Charles et al. (2013)]	996	No
Frames Labelled In Cinema [Sapp and Taskar (2013)]	10381	Yes

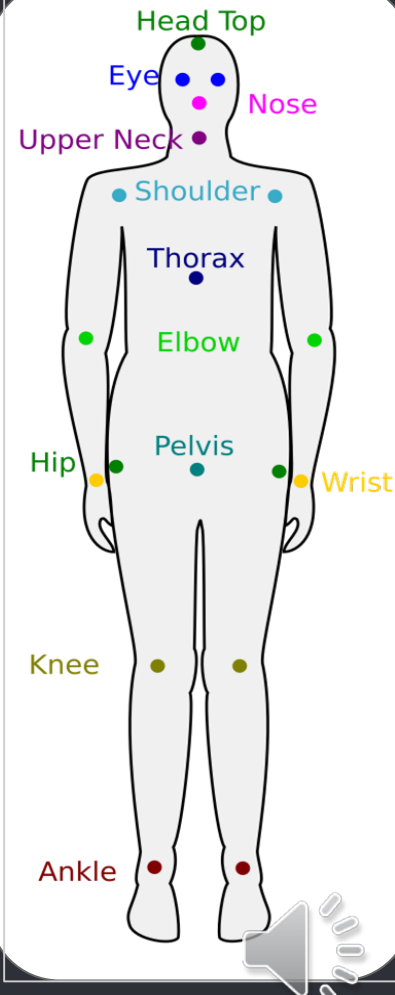


Cropped Uncropped



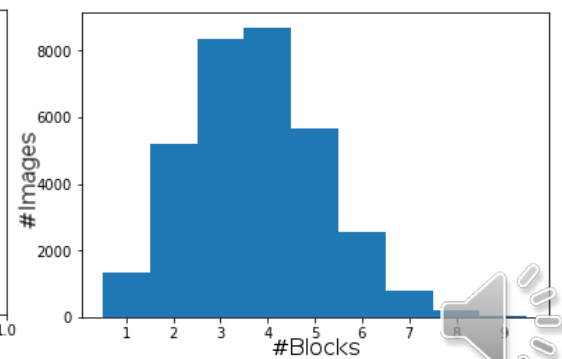
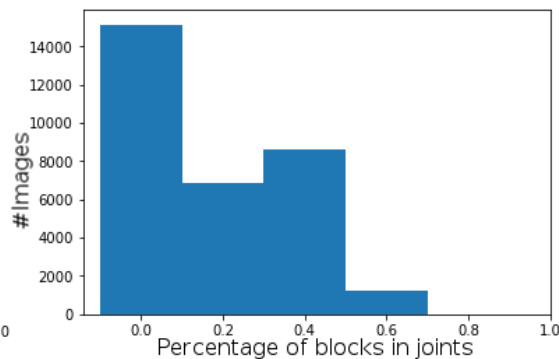
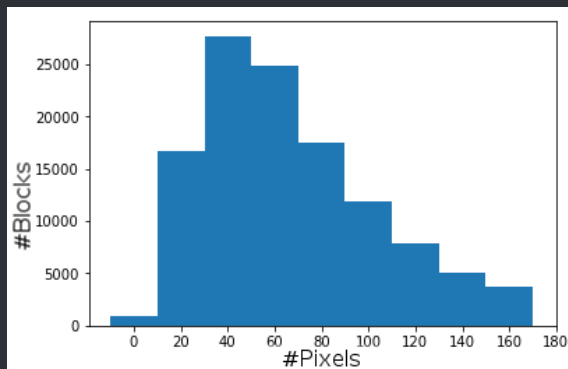
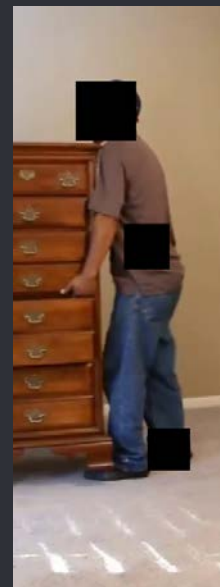
Joints

- No right/ left
- Not constant
- Standardized



Name	#Joints						4	5	6	7					
MPII	19	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
LSP	8	✓	✓	✓				✓	✓	✓	✓	✓	✓		
Synch	6							✓	✓	✓	✓	✓	✓		
BBC	4									✓	✓	✓	✓		
FLIC	6				✓						✓	✓	✓	✓	✓

Masks





METRICS

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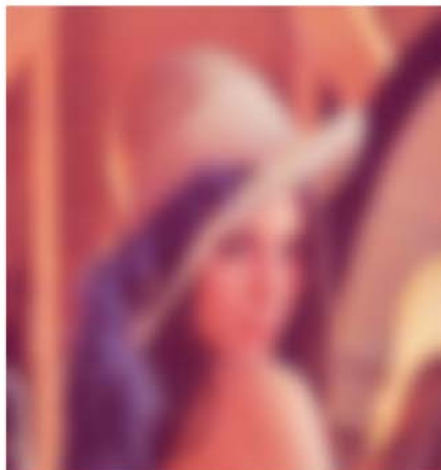
MSE, DSSIM

Original



MSE:
DSSIM:

Blur



531
0.40

Contrast



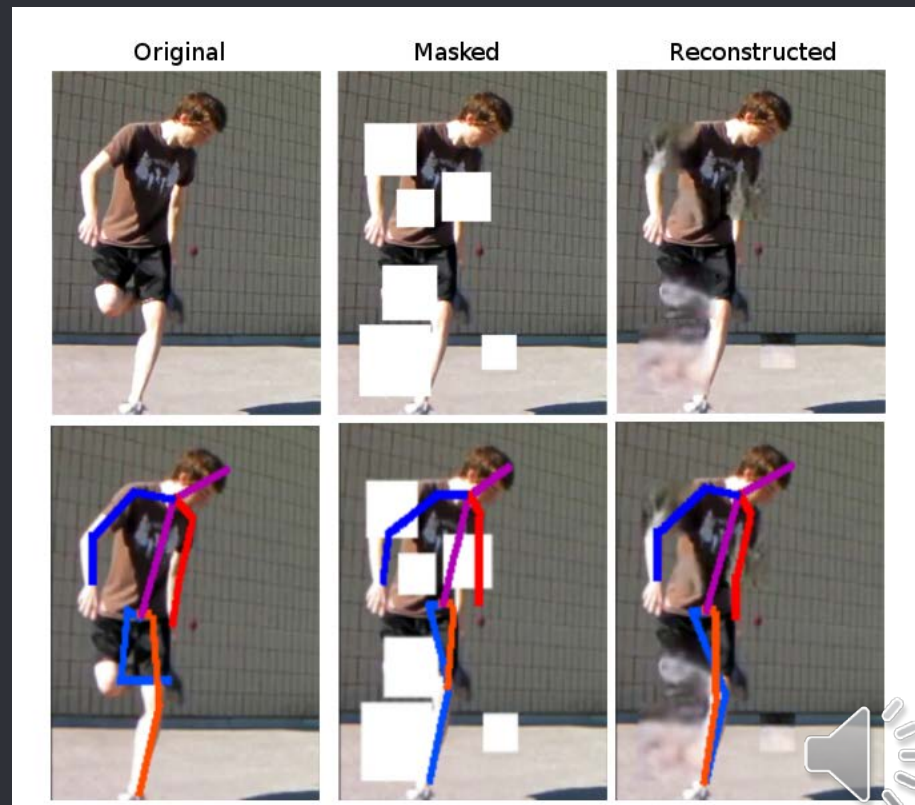
548
0.13



WNJD

- Evaluates semantic Knowledge

$$\frac{\sum_{i=0}^N |OJoint_i - PJoint_i|}{N ||(w, h)||}$$





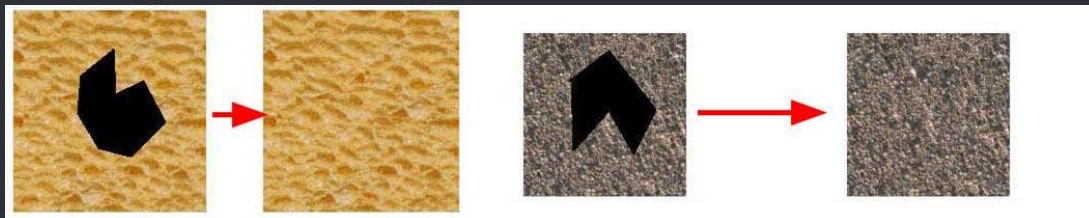
ANALYZED METHODS

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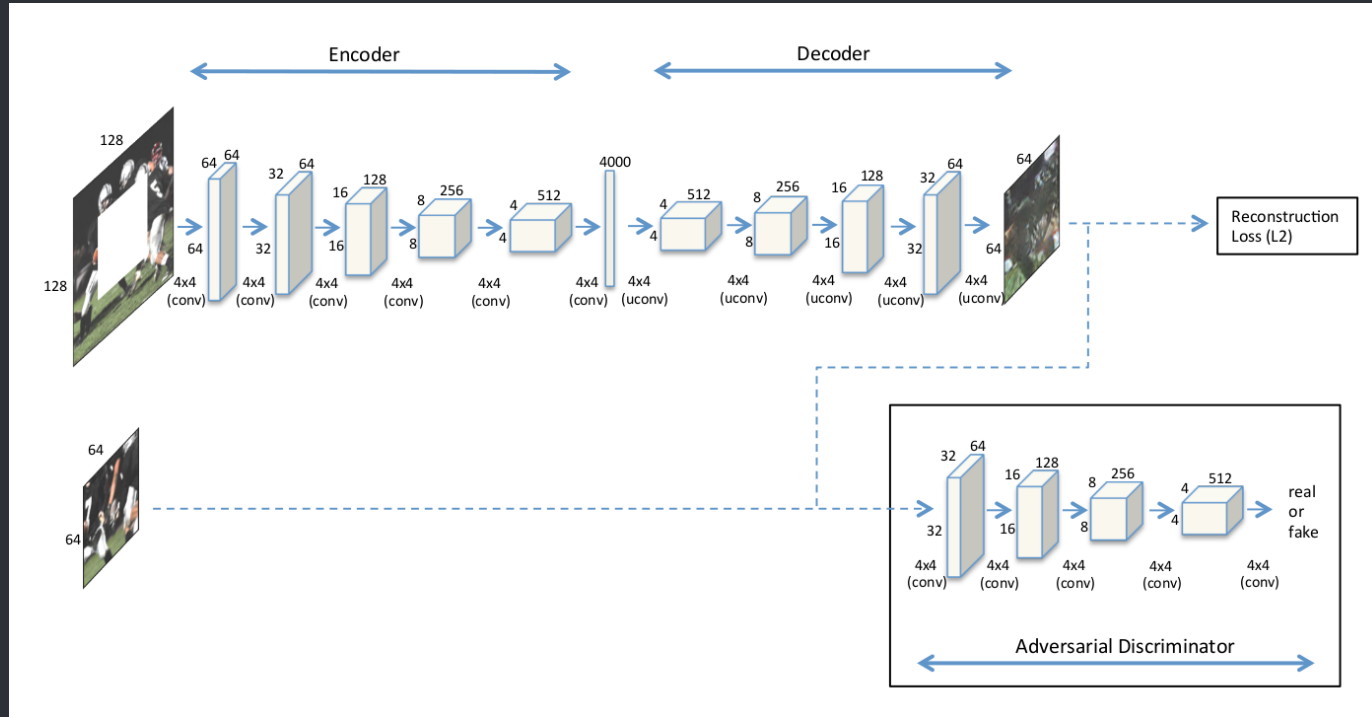


RELATED WORK

- Image quilting
- Not a lot of comparisons yet



CONTEXT ENCODERS - Architecture



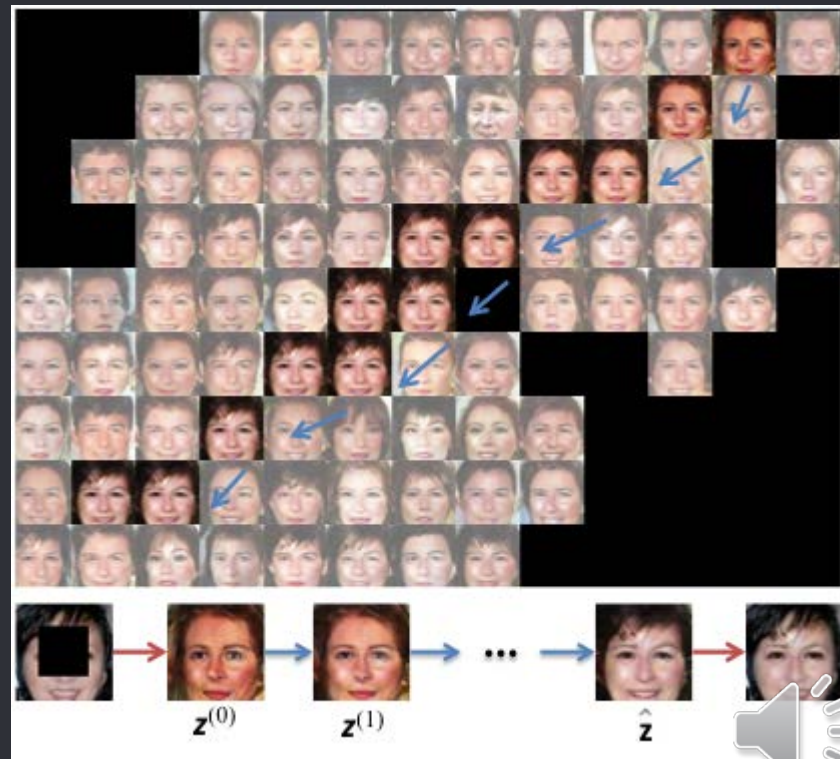
CONTEXT ENCODERS

- Two losses
- Autoencoder learns to reconstruct
- Channel-Wise Fully-Connected Layer

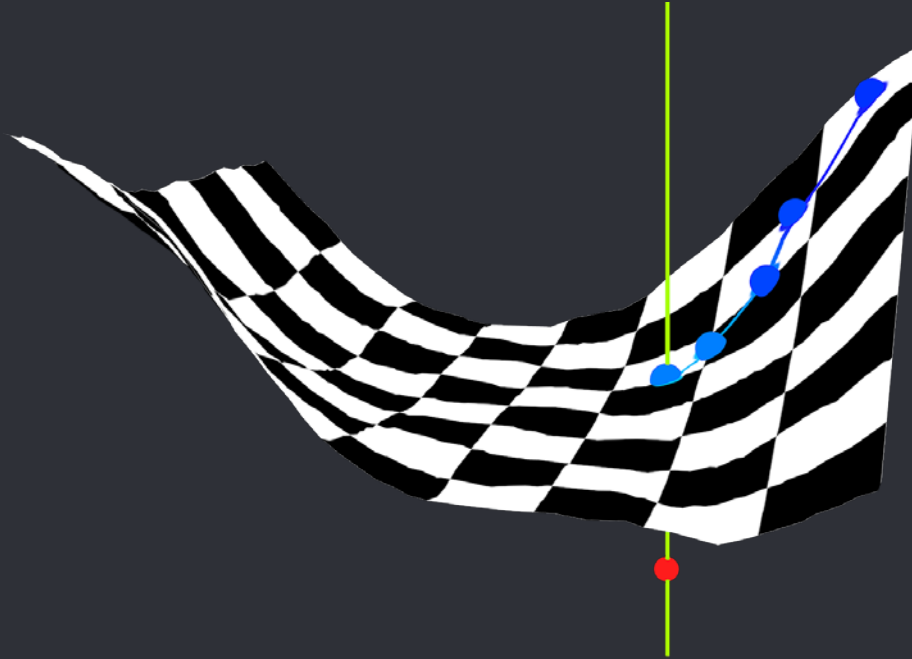


SEMANTIC IMAGE INPAINTING

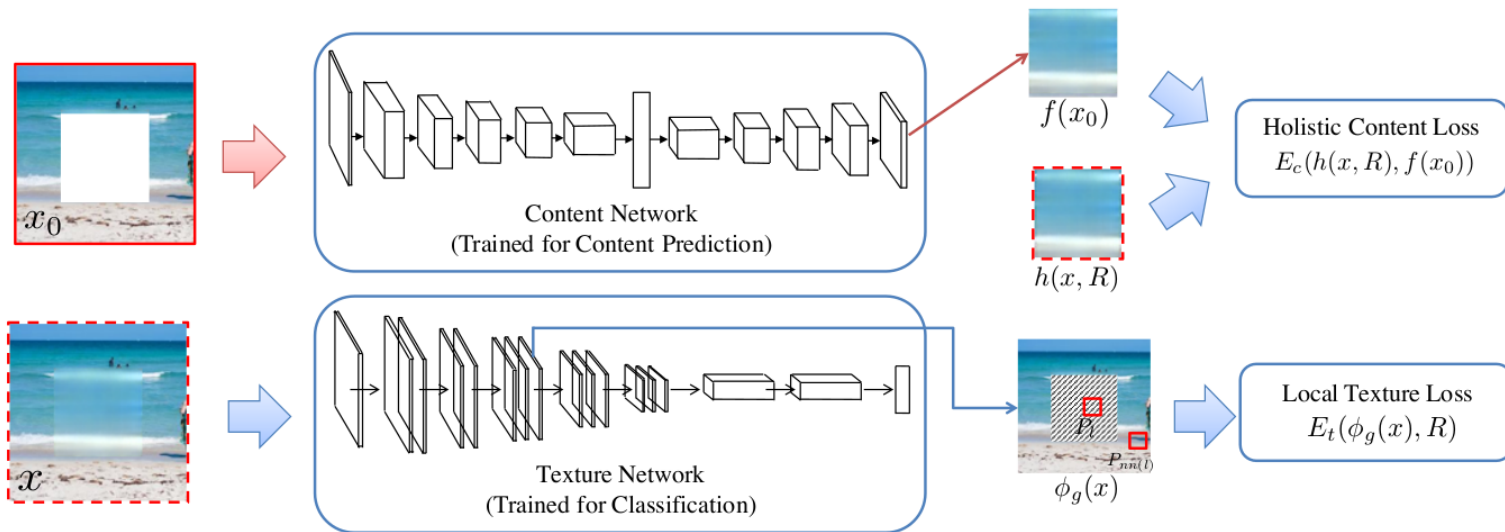
- GAN
- Two losses
- Learns manifold



SEMANTIC IMAGE INPAINTING



MULTI-SCALE NEURAL PATCH SYNTHESIS



MULTI-SCALE NEURAL PATCH SYNTHESIS

- Uses Context Encoders
- Iterative process increases resolution
- Focuses on textures
- Three losses



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SETUP

- 60% Train images (24647)
- 20% Validation (8214)
- 20% Test (8214)

Context Encoders/ Multi-Patch	
Epochs	180
λ_{rec}	0.999
Overlap	4
BottleNeck	4000

Semantic Image Inpainting	
Epochs	95
λ	0.2
Overlap	4
BottleNeck	2000



QUALITATIVE



Original



Mask



Context



Semantic



QUALITATIVE



Context Encoders
Patch



Semantic Inpainting

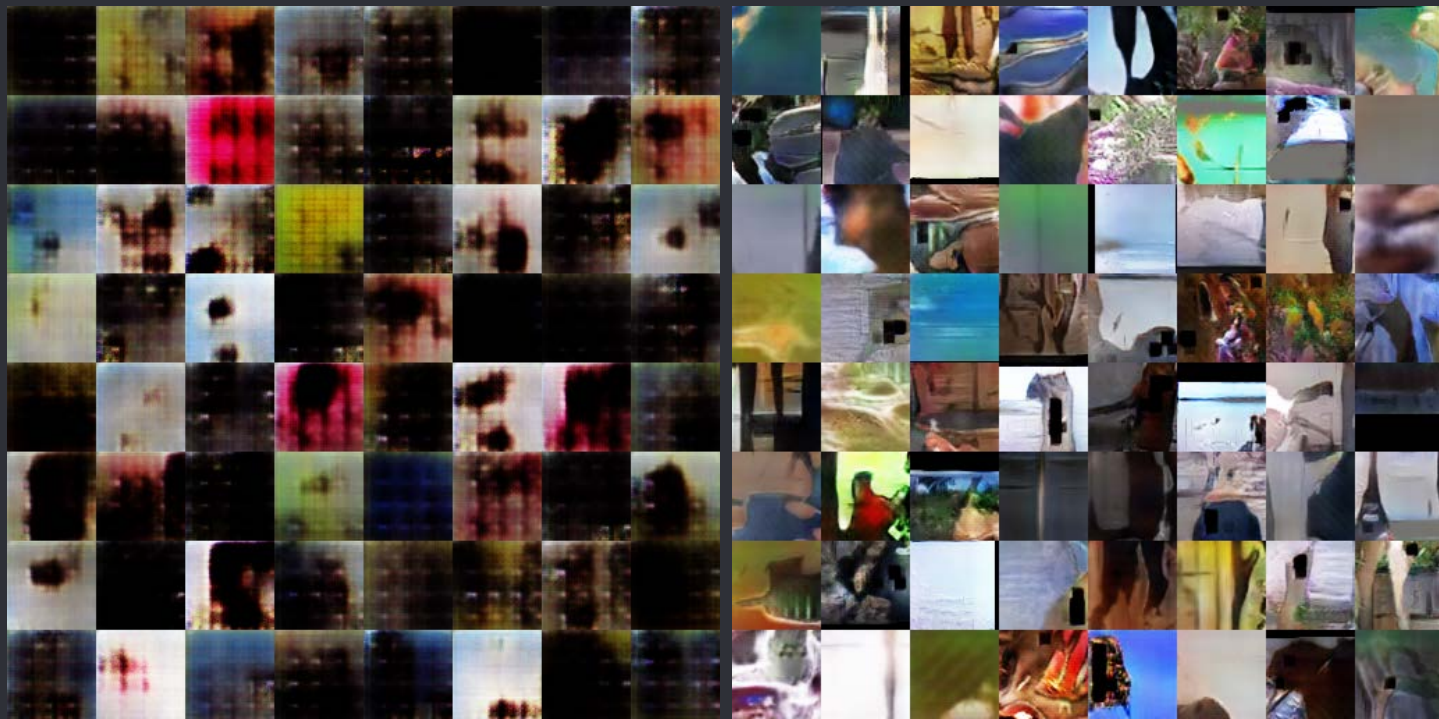


Multi-Scale Neural Inpainting

QUANTITATIVE

Name	DSSIM	MSE	WNJD
Context-Encoders (ImageNet Model)	0.2780	0.0393	0.2673
Context-Encoders	0.2756	0.0412	0.1489
Semantic Image Inpainting	0.3575	0.0472	0.2427
Multi-Scale Neural Patch	0.2530	0.0251	0.1505

MODEL

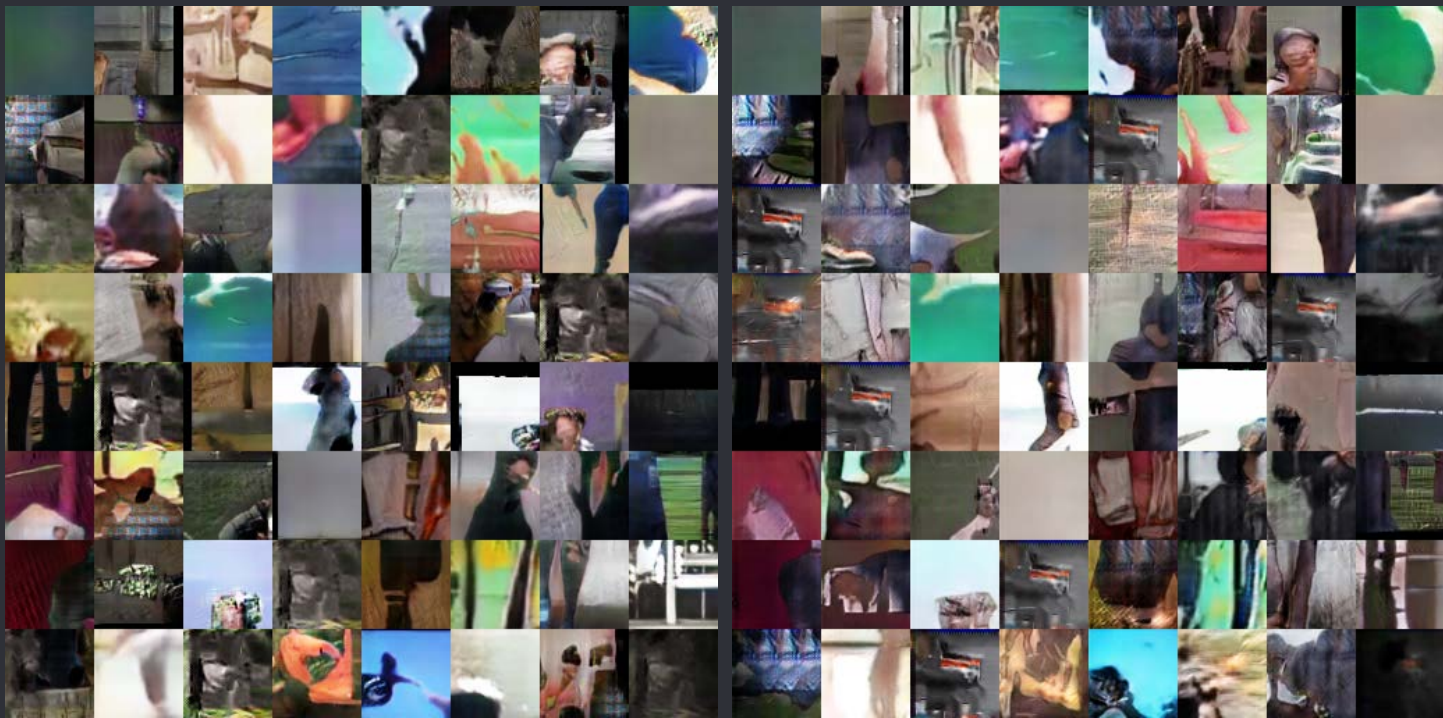


0

25



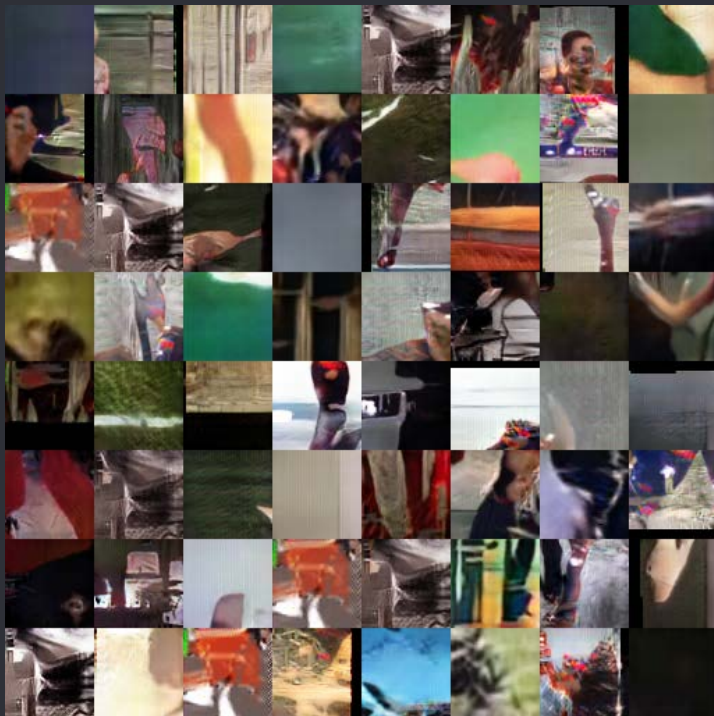
MODEL



95

200

MODEL



400



Semantic Image inpainting default model¹
(trained with faces)



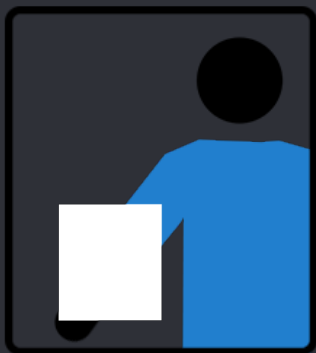


PROBLEMS AND DISCUSSION

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INFIGHTING BETWEEN OBJECTIVES



Similarity to original:

High

Low

Meh

Similarity to set:

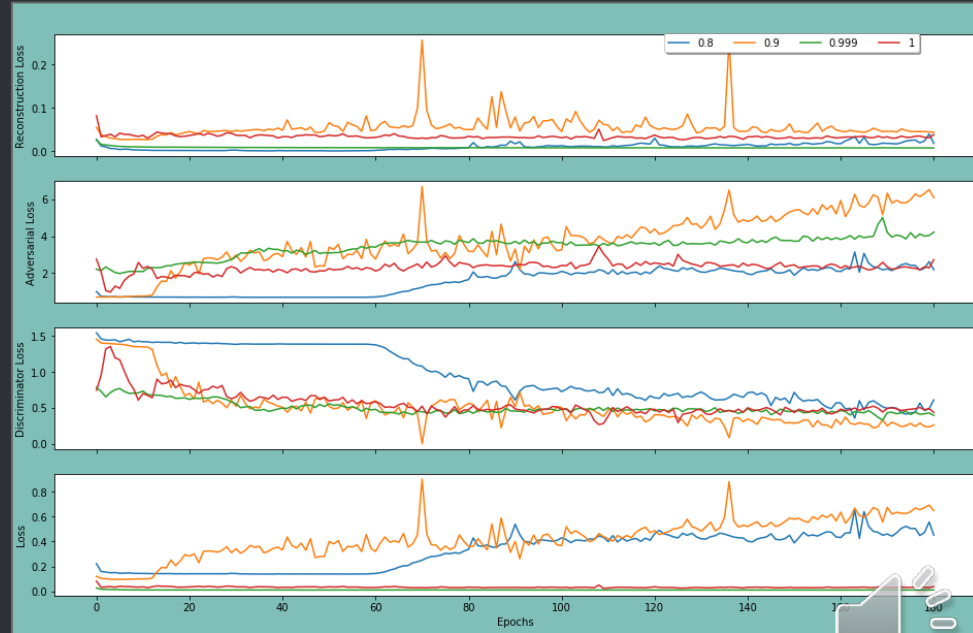
High

High

Low

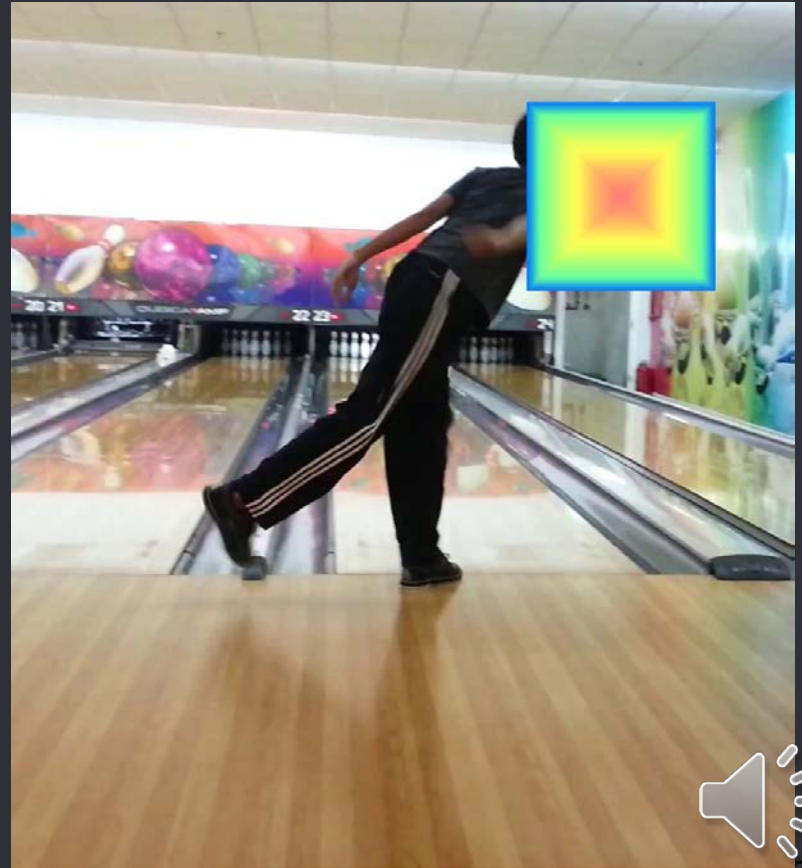


INSTABILITY



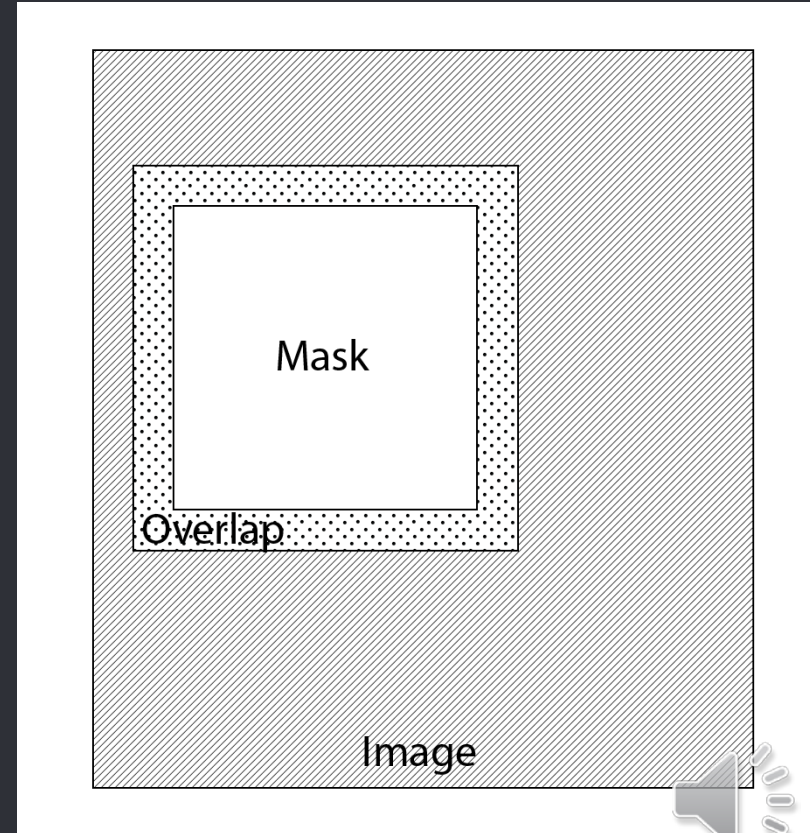
ONION

- Error accumulation



ONION - HOW THEY DEAL WITH IT

- Overlap
- Weighted Mask





COMPETITION

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COMPETITION

Tools



Docker

CodaLab

Conferences



IEEE WCCI 2018
Rio de Janeiro, Brazil

Accepted!



ECCV 2018

European Conference
on Computer Vision

8 – 14 September 2018 | Munich, Germany





CONCLUSIONS

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CONCLUSIONS

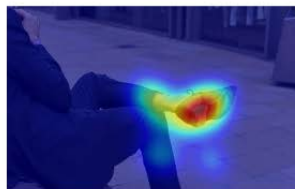
- Problems still left to tackle
- Stability is a bottleneck
- Textures vs semantic

FUTURE WORK

Model qualifying reconstructions



Suit



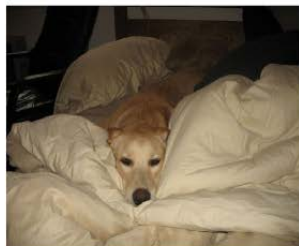
Loafer



Binoculars



Macaque



Quilt /
Comfortor



Labrador
Retriever



Window
Screen



Flower
Pot

Thanks for listening!

