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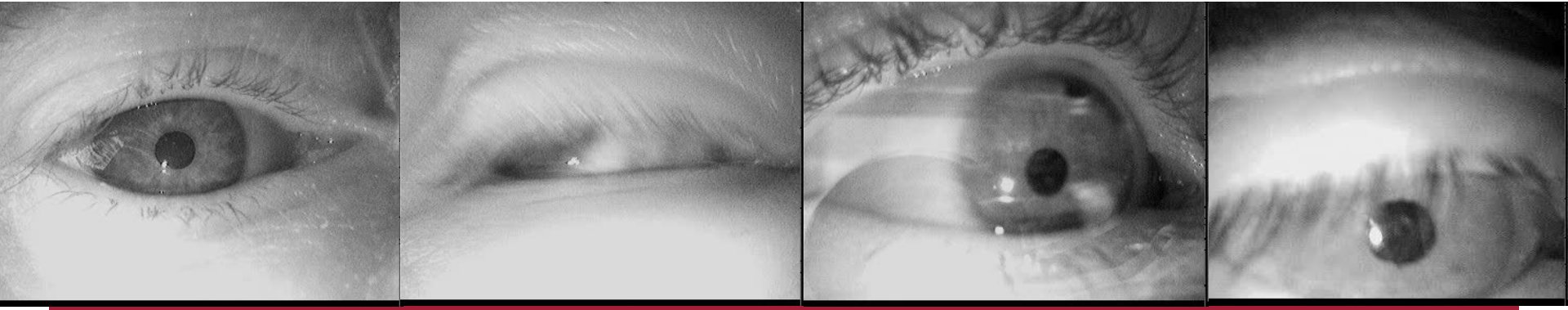
Human Computer Interaction



Fully Convolutional Neural Networks for Raw Eye Tracking Data Segmentation, Generation, and Reconstruction

Introduction

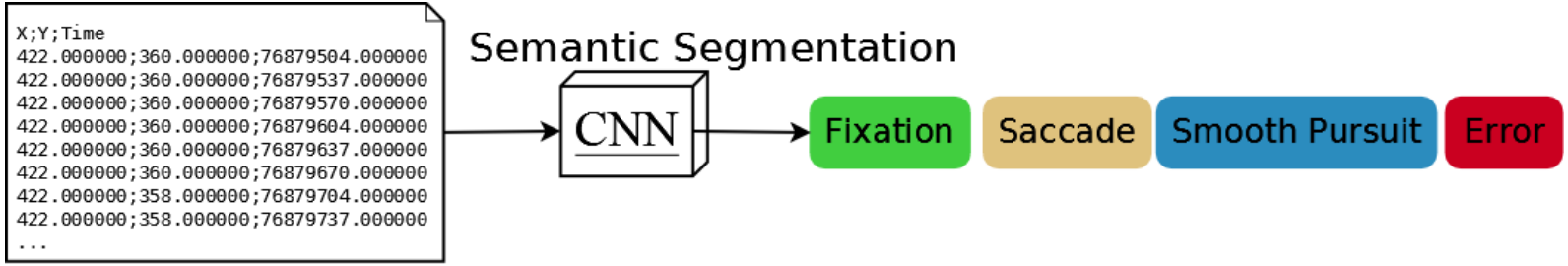
- Gaze consists of eye movement types
  - Fixation
  - Saccade
  - Smooth pursuit

- Can be used for Human Computer Interaction

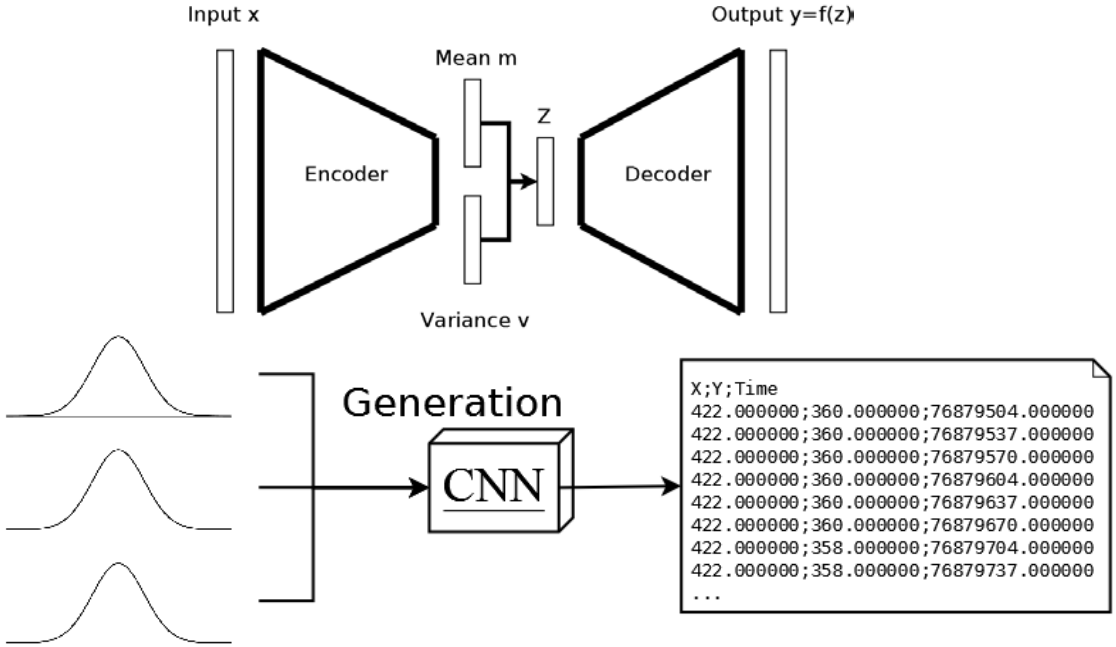
- Gaze patterns contain information about the task and the user (Driver)

- Gaze patterns contain expert knowledge (Surgeon)

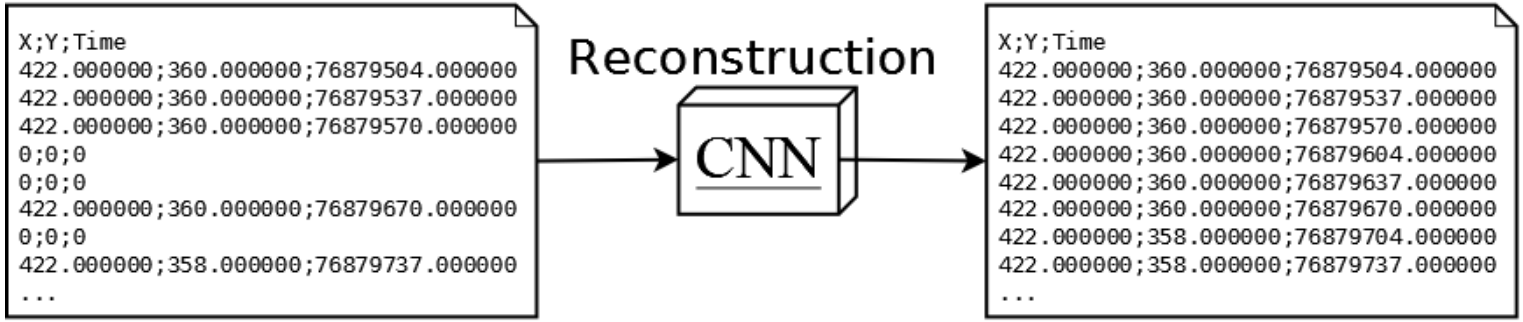
Segmentation



Generation


Input x
Output y=f(z)
Mean m
Z
Encoder
Decoder
Variance v
Generation
CNN
X;Y;Time
422.000000;360.000000;76879504.000000
422.000000;360.000000;76879537.000000
422.000000;360.000000;76879570.000000
422.000000;360.000000;76879604.000000
422.000000;360.000000;76879637.000000
422.000000;360.000000;76879670.000000
422.000000;358.000000;76879704.000000
422.000000;358.000000;76879737.000000
...

Reconstruction



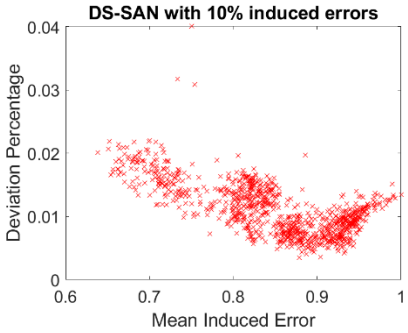
Results

Segmentation

Data	Alg.	Percision				
		Fixation	*Saccade*	*Pursuit*	*Noise*	*PSM*
DS-AND	EV	0.68	0.37	0	0.73	0.03
	IBDT	0.72	0.70	0.35	0	0
	LS	0.82	0.33	0.63	0.06	0
	I2MC	0.09	0.08	0	0	0
	RULE	0.79	0.65	0.82	0.59	0.32
	Proposed	**0.91**	**0.81**	**0.90**	**0.88**	**0.73**
DS-SAN	EV	0.78	0.31	0	0.01	-
	IBDT	0.93	0.73	0.76	0	-
	LS	0.77	0	0.23	0	-
	I2MC	0.76	0.071	0	0	-
	RULE	**0.98**	0.86	0.89	0.61	-
	HOV & knn5	0.96	0.91	0.91	0.82	-
	HOV & knn10	0.96	0.93	0.92	0.88	-
	HOV & knn15	0.96	0.94	0.91	0.87	-
	HOV & knn20	0.95	**0.95**	0.91	0.89	-
	HOV & tree1	0.97	0.90	0.89	0.79	-
	HOV & tree2	0.97	0.91	0.89	0.78	-
	HOV & tree3	0.97	0.91	0.89	0.84	-
	HOV & tree4	0.97	0.90	0.89	0.79	-
	HOV & tree5	0.97	0.91	0.88	0.84	-
	Proposed	**0.98**	**0.95**	**0.94**	**0.91**	-

Data	Alg.	Recall				
		Fixation	*Saccade*	*Pursuit*	*Noise*	*PSM*
DS-AND	EV	0.61	0.73	0	0.94	0.02
	IBDT	0.65	0.35	0.63	0	0
	LS	0.91	0.88	0.15	0.13	0
	I2MC	0.02	**0.95**	0	0	0
	RULE	0.79	0.85	0.69	0.67	0.78
	Proposed	**0.94**	0.93	**0.91**	**0.96**	**0.89**
DS-SAN	EV	0.18	0.25	0	**1.0**	-
	IBDT	0.97	0.28	0.84	0	-
	LS	0.95	0	0.06	0	-
	I2MC	0.92	0.10	0	0	-
	RULE	0.94	0.91	0.89	0.65	-
	HOV & knn5	0.97	0.73	0.91	0.70	-
	HOV & knn10	**0.98**,	0.70	0.91	0.70	-
	HOV & knn15	**0.98**	0.69	0.91	0.70	-
	HOV & knn20	**0.98**	0.68	0.91	0.70	-
	HOV & tree1	0.97	0.92	0.88	0.72	-
	HOV & tree2	0.97	0.91	0.88	0.72	-
	HOV & tree3	0.97	0.92	0.88	0.73	-
	HOV & tree4	0.97	0.92	0.88	0.72	-
	HOV & tree5	0.97	0.92	0.88	0.77	-
	Proposed	**0.98**	**0.95**	**0.94**	0.89	-

Reconstruction



Generation

		Blank	Natural	Puzzle	Waldo	Accuracy
Real Data	Blank	17	12	0	3	0.531
	Natural	3	50	0	3	0.892
	Puzzle	1	1	58	0	0.966
	Waldo	0	6	2	52	0.866
Gen. Data	Blank	386	350	59	205	0.386
	Natural	267	422	149	162	0.422
	Puzzle	400	73	419	108	0.419
	Waldo	281	181	45	493	0.493
Gen. Train	Blank	21	11	0	0	0.656
	Natural	2	53	0	1	0.946
	Puzzle	0	0	60	0	1.0
	Waldo	0	2	1	57	0.95

Thank you for your attention!