Homework #3 - Bonus Report

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Part 1 – 10 Homography matrices H(0)

10 points for two planes in each pair of images selected manually:

Image 1:

Plane 1				Plane 2			
Image 1		Image 2		Image 1		Image 2	
x	y	x	y	x	y	x	y
510	89	519	90	241	7	275	16
388	150	405	153	305	26	339	33
308	188	329	190	350	40	387	45
257	214	283	215	218	53	253	62
220	230	248	233	263	65	297	72
701	462	702	464	139	61	178	70
520	425	528	428	174	138	214	146
402	396	415	396	118	148	159	154
318	381	339	381	147	16	187	26
378	618	392	617	111	99	154	106

Image 2:

Plane 1				Plane 2			
Image 1		Image 2		Image 1		Image 2	
x	y	x	y	x	y	x	y
113	399	117	399	606	439	623	440
151	392	155	391	684	377	706	376
201	387	207	386	424	363	448	362
203	366	211	365	340	329	362	329
127	361	137	360	593	309	619	308
87	358	99	357	426	276	455	275
41	359	52	358	617	243	647	242
11	389	16	388	215	459	231	459
113	410	114	410	476	392	496	391
119	378	125	377	293	226	323	225

Image 3:

Plane 1				Plane 2			
Image 1		Image 2		Image 1		Image 2	
x	y	x	y	x	y	x	y

166	170	161	169	83	169	78	170
193	156	186	157	59	156	52	157
165	217	160	216	37	144	28	146
157	281	152	280	84	216	79	217
201	187	194	186	60	199	53	202
219	145	211	144	38	184	28	187
230	192	220	192	82	255	77	257
204	246	196	245	61	247	53	250
184	304	177	304	41	231	32	234
238	187	229	186	45	279	35	283

Image 4:

Plane 1				Plane 2			
Image 1		Image 2		Image 1		Image 2	
x	y	x	y	x	y	x	y
11	7	7	7	158	204	162	203
36	10	32	10	150	182	153	180
14	16	10	16	108	199	112	198
32	18	29	18	235	162	236	160
14	39	11	39	184	170	186	168
32	40	29	40	106	215	111	215
41	64	37	64	277	159	276	157
22	40	18	40	198	150	196	149
42	81	38	81	123	158	124	157
22	60	19	60	20	182	23	183

Image 5:

Plane 1				Plane 2			
Image 1		Image 2		Image 1		Image 2	
x	y	x	y	x	y	x	y
321	75	287	75	192	199	185	196
288	78	255	79	208	202	202	200
347	72	312	72	224	195	216	194
387	68	351	68	205	154	199	153
323	36	290	36	205	187	199	186
171	48	137	48	165	183	157	181
381	159	347	159	208	119	203	118
408	192	374	192	193	142	189	139
425	121	390	121	246	160	240	159
293	96	260	96	205	89	203	86

10 Homography matrices:

Image 1 – Plane 1:

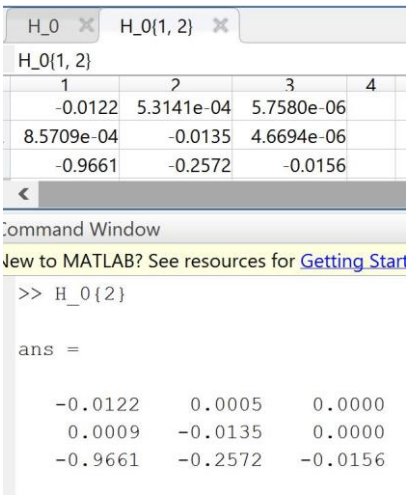


Image 1 – Plane 2:

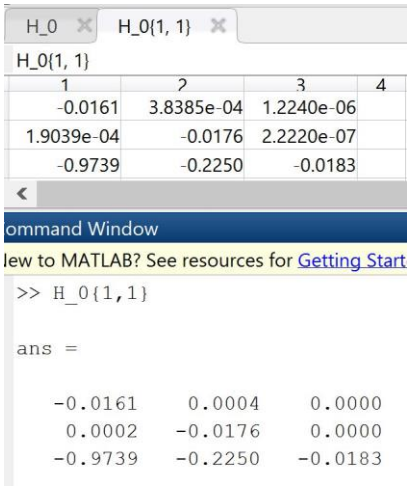


Image 2 – Plane 1:

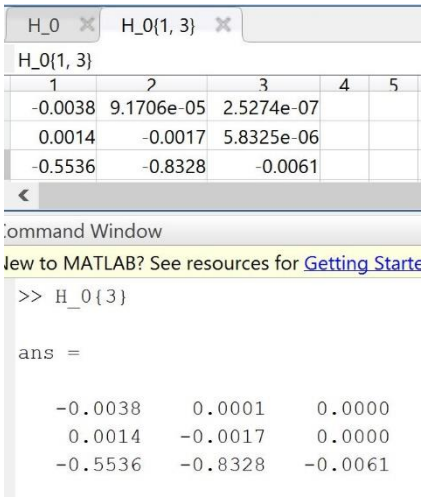


Image 2 – Plane 2:

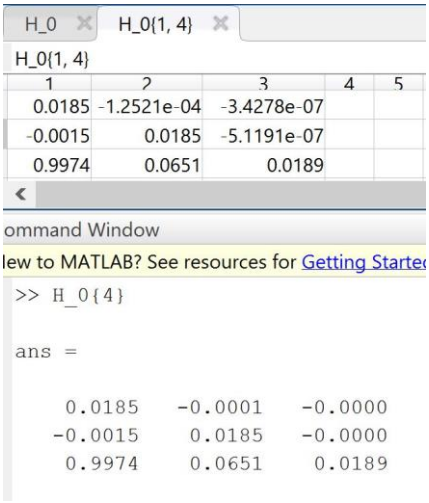


Image 3 – Plane 1:

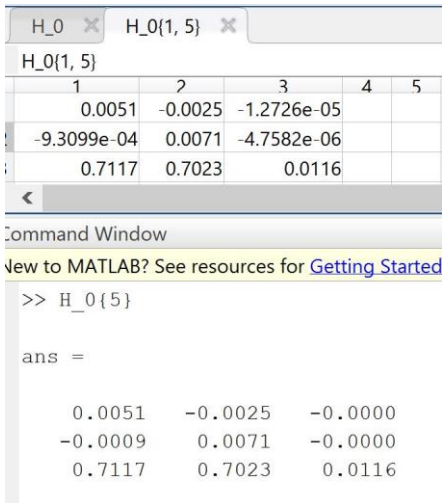


Image 3 – Plane 2:

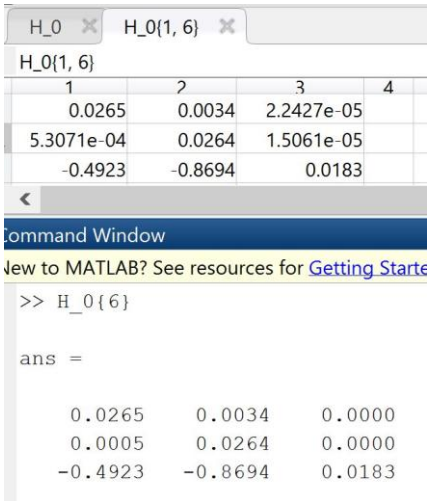


Image 4 – Plane 1:

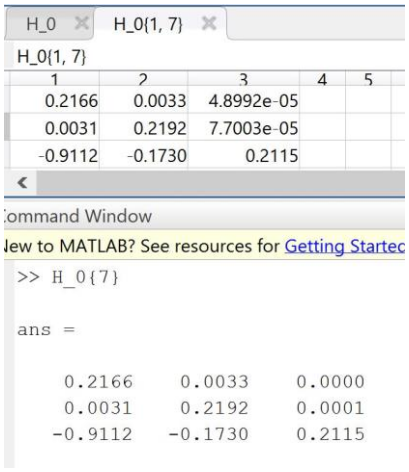


Image 4 – Plane 2:

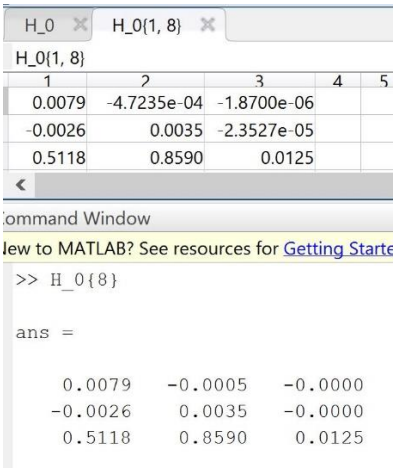


Image 5 – Plane 1:

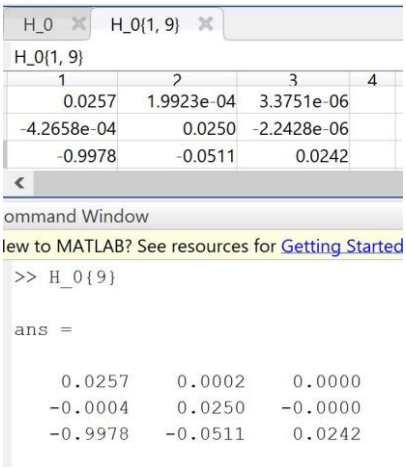
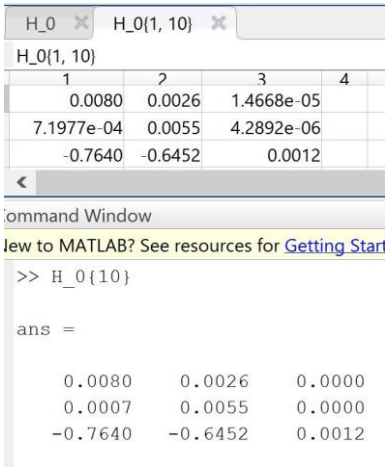


Image 5 – Plane 2:



Part 2 – 10 Homography Matrices H

Image 1 – Plane 1:

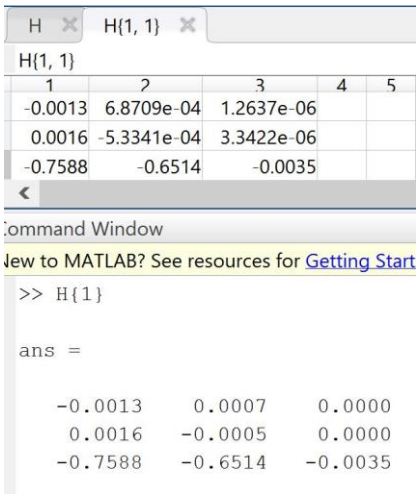


Image 1 – Plane 2:

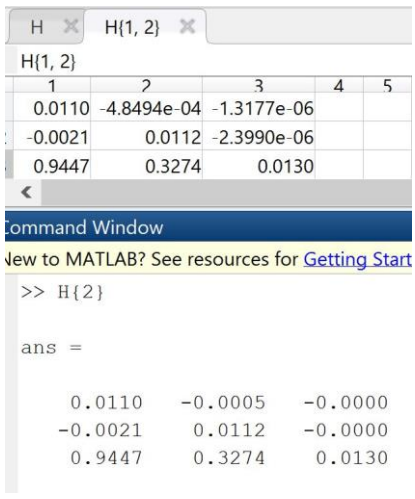


Image 2 – Plane 1:

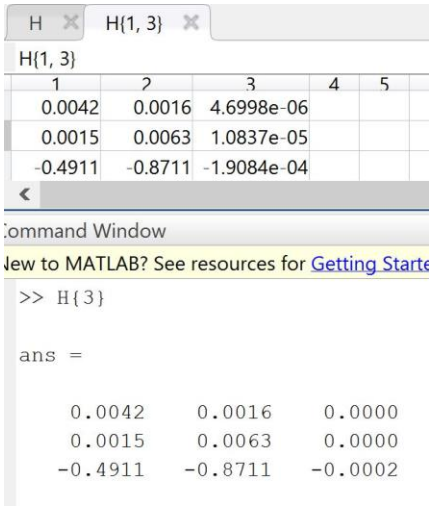


Image 2 – Plane 2:

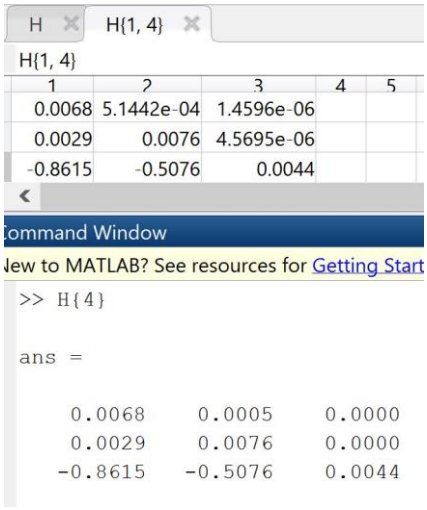


Image 3 – Plane 1:

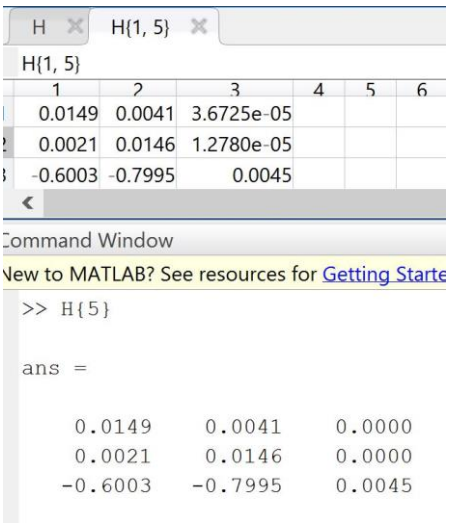


Image 3 – Plane 2:

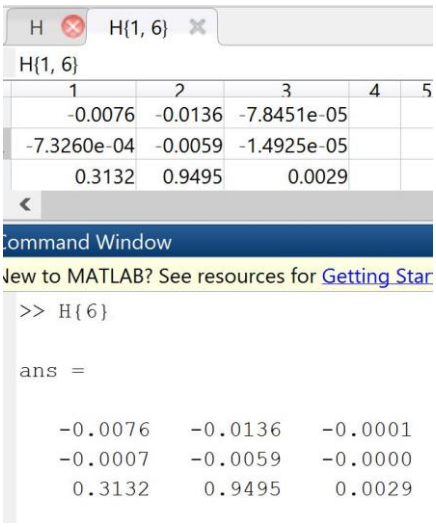


Image 4 – Plane 1:

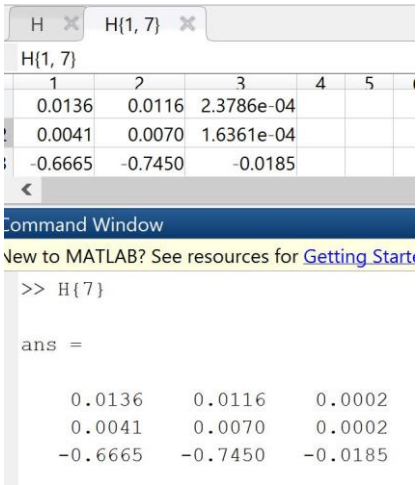


Image 4 – Plane 2:

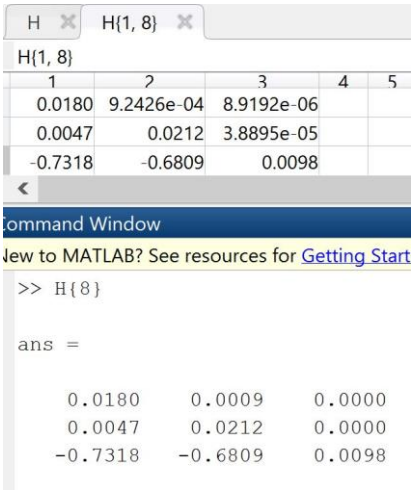
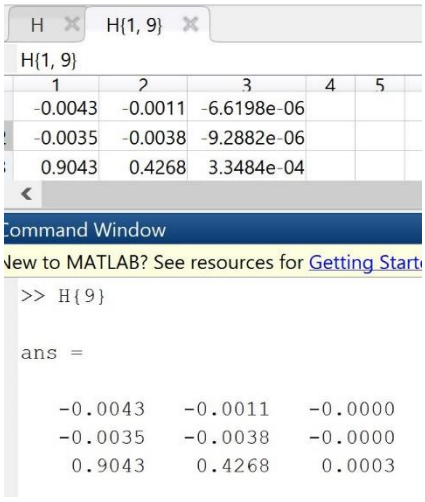


Image 5 – Plane 1: Image 5 – Plane 2:



Part 3 – New Many-to-many Matching Formulation:

$$\max_{Z}(w^T - f^T - h_1Y_1 - h_2Y_2)Z, \qquad s.t.\ \|Z\|_2^2 = 1, Z \in [0,1]^{100\times100}$$

Where w is the similarity vector calculated in the Homework 3.

$f = [\dots\ x_iFx_j\ \dots]^T$ where F is the fundamental matrix calculated in the Homework 3.

x_i and x_j is the SURF points in image 1 and image 2.

$h_1 = [\dots 0 \dots H_1X_{ij} + H_1Y_{ij} \dots 0 \dots]^T$ and $h_2 = [\dots 0 \dots H_2X_{ij} + H_2Y_{ij} \dots 0 \dots]^T$

Where H_1 and H_2 are the homography matrices calculated from previous steps.

X_{ij} and Y_{ij} are the each two of SURF points in image 1 and image 2.

$Y_1 = [\dots 0 \dots 1 \dots 0 \dots]^T$ and $Y_2 = [\dots 0 \dots 1 \dots 0 \dots]^T$

Where $\begin{cases} Y_1 = 1 & if\ h_1 \approx 0 \\ Y_1 = 0 & if\ h_1\ is\ large \end{cases}$ and $\begin{cases} Y_2 = 1 & if\ h_2 \approx 0 \\ Y_2 = 0 & if\ h_2\ is\ large \end{cases}$

Z is the new $(100 \cdot 100) \times 1$ binary vector indicating matches.

Part 4 – New Zs and Comparison:

The new Zs are still 1×10000 vectors, and they are impossible to print here in the report. However, the number of matchings could be shown here:

Image 1: 544 Image 2: 169 image 3: 594 image 4: 39 Image 5: 7394

To compare with the old z vector, they both detect some same matches. The indices of these matchings will be shown here:

Image 1: 202 6257 7154 7395 9354

Image 2: 9243

Image 3: 89 122 740 1411 1523 1536 1711 1912 6022 6225 7123 9596

Image 4: 7396 9981

Image 5: 37 59 65 80 186 360 606 610 667 705 874 894 1037 1059 1065 1080 1109 1116 1121 1278 1315 1323 1353 1376 1378 1515 1523 1553 1576 1578 1642 1812 1887 1907 1918 2011 2112 2187 2223 2433 2440 2853 2869 2876 2981 3000 3381 3400 3414 3452 3697 3883 3928 4097 4262 4291 4515 4523 4578 4787 4928 5162 5191 5467 5489 5653 5676 5724 5759 5765 5827 5837 5859 6028 6245 6246 6281 6300 6335 6372 6558 6587 6590 6685 6709 6716 6870 7103 7138 7168 7488 7675 8034 8097 8478 8531 8579 8585 8594 8643 8713 9052 9067 9089 9114 9184 9370 9484 9503 9525 9527 9637 9659 9665 9979

Part 5 – Printout of Software:

Matlab