R10922196 方郁婷

Description

- Calculate theoretical values (FOV, 視野) and compare with measured values
- Use lens of focal length: `18mm`, `53mm`, `135mm` 鏡頭的焦距(f)
- Object displacement of: `1mm`, `5mm`, `10mm`, `20mm` 物體每張照片的位移(實際位移, 由照片檔名可知)
- Object distance of: `0.6m`, `1.2m`, `1.8m` 相機與物體的距離 (object distance, 由照片檔名可知)
- Camera : `Pentax K-7, 18-135mm` 相機的型號
- Sensor size : `23.4 x 15.6 mm` => sensor wisth = 23.4

位移的 pixel 可用小畫家去計算
mm per pixel = 實際位移/pixel 位移

套用以下公式可計算理論數值與實際數值

使用 excel 去計算

- **FOV** theoretical value (f = 135mm, sensor width = 23.4mm):

$$\text{FOV} = 2 \times \arctan\left(\frac{sensor\ width}{2 \times f}\right) \times \frac{180}{\pi}$$

- **FOV** measured value:

$$\text{FOV} = 2 \times \arctan\left(\frac{Image\ width(in\ pixel) \times \text{mm per pixel}}{2 \times object\ distance}\right) \times \frac{180}{\pi}$$

Result

18mm		實際位移	x	位移 Pixel	mm/pixel	FOV 估計	FOV 理論
600mm_0mm	600	0	2255				
600mm_1mm	600	1	2260	5	0.2	75.813	66.047

						41	74
600mm_5mm	600	5	2279	24	0.208333	78.09179	66.04774
600mm_10mm	600	10	2307	52	0.192308	73.64571	66.04774
600mm_20mm	600	20	2354	99	0.20202	76.37237	66.04774
1200mm_0mm	1200	0	2324				
1200mm_1mm	1200	1	2327	3	0.333333	65.95818	66.04774
1200mm_5mm	1200	5	2340	16	0.3125	62.62709	66.04774
1200mm_10mm	1200	10	2355	31	0.322581	64.25411	66.04774
1200mm_20mm	1200	20	2380	56	0.357143	69.617	66.04774
1800mm_0mm	1800	0	2317				
1800mm_1mm	1800	1	2319	2	0.5	65.95818	66.04774
1800mm_5mm	1800	5	2328	11	0.454545	61.07262	66.04774
1800mm_10mm	1800	10	2336	19	0.526316	68.66935	66.04774
1800mm_20mm	1800	20	2362	45	0.444444	59.95185	66.04774
53mm		實際位移	x	位移 Pixel	mm/pixel	FOV 估計	FOV 理論
600mm_0mm	600	0	2221				
600mm_1mm	600	1	2244	23	0.043478	19.21538	24.89732
600mm_5mm	600	5	2284	63	0.079365	34.34174	24.89732
600mm_10mm	600	10	2350	129	0.077519	33.58855	24.89732

600mm_20mm	600	20	2485	264	0.075758	32.86679	24.89732
1200mm_0mm	1200	0	2362				
1200mm_1mm	1200	1	2372	10	0.1	22.03162	24.89732
1200mm_5mm	1200	5	2406	44	0.113636	24.94729	24.89732
1200mm_10mm	1200	10	2442	80	0.125	27.35236	24.89732
1200mm_20mm	1200	20	2526	164	0.121951	26.70941	24.89732
1800mm_0mm	1800	0	2382				
1800mm_1mm	1800	1	2395	13	0.076923	11.40179	24.89732
1800mm_5mm	1800	5	2420	38	0.131579	19.38075	24.89732
1800mm_10mm	1800	10	2440	58	0.172414	25.22492	24.89732
1800mm_20mm	1800	20	2484	102	0.196078	28.55367	24.89732
135mm		實際位移	x	位移 Pixel	mm/pixel	FOV 估計	FOV 理論
600mm_0mm	600	0	2120				
600mm_1mm	600	1	2177	57	0.017544	7.814934	9.906515
600mm_5mm	600	5	2277	157	0.031847	14.13623	9.906515
600mm_10mm	600	10	2382	262	0.038168	16.90466	9.906515
600mm_20mm	600	20	2622	502	0.039841	17.6341	9.906515
1200mm_0mm	1200	0	2427				
1200mm_1m	1200	1	2465	38	0.02631	5.8651	9.9065

m					6	77	15
1200mm_5mm	1200	5	2490	63	0.079365	17.56521	9.906515
1200mm_10mm	1200	10	2570	143	0.06993	15.50411	9.906515
1200mm_20mm	1200	20	2740	313	0.063898	14.18094	9.906515
1800mm_0mm	1800	0	2270				
1800mm_1mm	1800	1	2275	5	0.2	29.10072	9.906515
1800mm_5mm	1800	5	2304	34	0.147059	21.60989	9.906515
1800mm_10mm	1800	10	2357	87	0.114943	16.96849	9.906515
1800mm_20mm	1800	20	2480	210	0.095238	14.09181	9.906515