```
vince >.\run.ps1
{'radius': 4, 'num_warp': 3, 'gaussian': False, 'prefilter': False}
2025.03.11-15:48:07 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowILK_parms.json
2025.03.11-15:48:07 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowILK
2025.03.11-15:48:07 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-15:48:07 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-15:48:07 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:48:07 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-15:48:13 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:48:13 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-15:48:18 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-15:48:18 [ot.main - 229][INFO] - Applicazione MINMAX mediante libreria skimage
2025.03.11-15:48:18 [ot.image_processing.ski.minmax - 123][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:48:18 [ot.main - 229][INFO] - Applicazione MINMAX mediante libreria skimage
2025.03.11-15:48:18 [ot.image_processing.ski.minmax - 123][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:48:18 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:48:18 [ot.main - 235][INFO] - MINMAX eseguito correttamente.
2025.03.11-15:48:18 [ot.main - 236][DEBUG] - Output MINMAX:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-15:48:18 [ot.algoritmi.__call__ - 234][INFO] - Eseguo algoritmo skimage.registration.optical_flow_ilk
2025.03.11-15:48:18 [ot.algoritmi.__call__ - 235][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-15:48:18 [ot.algoritmi.__call__ - 236][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('uint8')
2025.03.11-15:49:43 [ot.algoritmi.__call__ - 242][DEBUG] - Numero output: 2
2025.03.11-15:49:43 [ot.algoritmi.__call__ - 243][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-15:49:43 [ot.algoritmi.__call__ - 244][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-15:49:44 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowILK eseguito correttamente
2025.03.11-15:49:44 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-ilk.minmax.tiff
2025.03.11-15:49:44 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.261
2025.03.11-15:49:44 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.147
2025.03.11-15:49:44 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.452
```

```
2025.03.11-15:49:44 [ot._summary_statistics - 197][DEBUG] -              OT Minimo:  0
2025.03.11-15:49:44 [ot._summary_statistics - 198][DEBUG] -             OT Massimo:  51.3
2025.03.11-15:49:45 [ot._summary_statistics - 199][DEBUG] -           OT 25° perc.:  0
2025.03.11-15:49:45 [ot._summary_statistics - 200][DEBUG] -           OT 75° perc.:  0.331
2025.03.11-15:49:45 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-ilk.minmax.tiff
{'radius': 4, 'num_warp': 3, 'gaussian': False, 'prefilter': False}
2025.03.11-15:49:46 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowILK_parms.json
2025.03.11-15:49:46 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowILK
2025.03.11-15:49:46 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-15:49:46 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-15:49:46 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:49:46 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-15:49:51 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:49:51 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-15:49:57 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-15:49:57 [ot.main - 229][INFO] - Applicazione ZSCORE mediante libreria skimage
2025.03.11-15:49:57 [ot.image_processing.ski.zscore - 109][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-15:49:57 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:49:57 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:49:57 [ot.main - 229][INFO] - Applicazione ZSCORE mediante libreria skimage
2025.03.11-15:49:57 [ot.image_processing.ski.zscore - 109][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-15:49:57 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:49:57 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:49:58 [ot.main - 235][INFO] - ZSCORE eseguito correttamente.
2025.03.11-15:49:58 [ot.main - 236][DEBUG] - Output ZSCORE:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-15:49:58 [ot.algoritmi.__call__ - 234][INFO] - Eseguo algoritmo skimage.registration.optical_flow_ilk
2025.03.11-15:49:58 [ot.algoritmi.__call__ - 235][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('float64')
2025.03.11-15:49:58 [ot.algoritmi.__call__ - 236][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('float64')
2025.03.11-15:51:13 [ot.algoritmi.__call__ - 242][DEBUG] - Numero output: 2
2025.03.11-15:51:13 [ot.algoritmi.__call__ - 243][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-15:51:13 [ot.algoritmi.__call__ - 244][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-15:51:14 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowILK eseguito correttamente
2025.03.11-15:51:14 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-ilk.zscore.tiff
2025.03.11-15:51:14 [ot._summary_statistics - 194][DEBUG] -              OT Media:  553
2025.03.11-15:51:14 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.165
2025.03.11-15:51:14 [ot._summary_statistics - 196][DEBUG] -                OT STD:  2.97e+05
2025.03.11-15:51:14 [ot._summary_statistics - 197][DEBUG] -              OT Minimo:  0
2025.03.11-15:51:14 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  3.79e+08
```

```
2025.03.11-15:51:14 [ot._summary_statistics - 199][DEBUG] -           OT 25° perc.:  0
2025.03.11-15:51:15 [ot._summary_statistics - 200][DEBUG] -           OT 75° perc.:  0.371
2025.03.11-15:51:15 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-ilk.zscore.tiff
{'radius': 4, 'num_warp': 3, 'gaussian': False, 'prefilter': False}
2025.03.11-15:51:16 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowILK_parms.json
2025.03.11-15:51:16 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowILK
2025.03.11-15:51:16 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-15:51:16 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-15:51:16 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:51:16 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-15:51:21 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:51:21 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-15:51:26 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-15:51:26 [ot.main - 229][INFO] - Applicazione CLAHE mediante libreria skimage
2025.03.11-15:51:26 [ot.image_processing.ski.clahe - 86][INFO] - Eseguo skimage.exposure.equalize_adapthist
2025.03.11-15:51:26 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:51:26 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:51:26 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:51:26 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:51:41 [ot.main - 229][INFO] - Applicazione CLAHE mediante libreria skimage
2025.03.11-15:51:41 [ot.image_processing.ski.clahe - 86][INFO] - Eseguo skimage.exposure.equalize_adapthist
2025.03.11-15:51:41 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:51:41 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:51:41 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:51:41 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:51:55 [ot.main - 235][INFO] - CLAHE eseguito correttamente.
2025.03.11-15:51:55 [ot.main - 236][DEBUG] - Output CLAHE:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-15:51:55 [ot.algoritmi.__call__ - 234][INFO] - Eseguo algoritmo skimage.registration.optical_flow_ilk
2025.03.11-15:51:55 [ot.algoritmi.__call__ - 235][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('float64')
2025.03.11-15:51:55 [ot.algoritmi.__call__ - 236][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('float64')
2025.03.11-15:53:22 [ot.algoritmi.__call__ - 242][DEBUG] - Numero output: 2
2025.03.11-15:53:22 [ot.algoritmi.__call__ - 243][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-15:53:22 [ot.algoritmi.__call__ - 244][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-15:53:22 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowILK eseguito correttamente
2025.03.11-15:53:22 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-ilk.clahe.tiff
2025.03.11-15:53:23 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.917
```

```
2025.03.11-15:53:23 [ot._summary_statistics - 195][DEBUG] -             OT Mediana:  0.192
2025.03.11-15:53:23 [ot._summary_statistics - 196][DEBUG] -                 OT STD:  126
2025.03.11-15:53:23 [ot._summary_statistics - 197][DEBUG] -              OT Minimo:  0
2025.03.11-15:53:23 [ot._summary_statistics - 198][DEBUG] -             OT Massimo:  4.59e+05
2025.03.11-15:53:23 [ot._summary_statistics - 199][DEBUG] -           OT 25° perc.:  0
2025.03.11-15:53:23 [ot._summary_statistics - 200][DEBUG] -           OT 75° perc.:  0.563
2025.03.11-15:53:24 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-ilk.clahe.tiff
{'radius': 4, 'num_warp': 3, 'gaussian': False, 'prefilter': False}
2025.03.11-15:53:25 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowILK_parms.json
2025.03.11-15:53:25 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowILK
2025.03.11-15:53:25 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-15:53:25 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-15:53:25 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:53:25 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-15:53:30 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:53:30 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-15:53:35 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-15:53:35 [ot.main - 229][INFO] - Applicazione LOGNORM mediante libreria skimage
2025.03.11-15:53:35 [ot.image_processing.ski.lognorm - 96][INFO] - Eseguo skimage.exposure.adjust_log
2025.03.11-15:53:35 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:53:35 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:53:35 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:53:35 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:53:36 [ot.main - 229][INFO] - Applicazione LOGNORM mediante libreria skimage
2025.03.11-15:53:36 [ot.image_processing.ski.lognorm - 96][INFO] - Eseguo skimage.exposure.adjust_log
2025.03.11-15:53:36 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:53:36 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:53:36 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:53:36 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:53:37 [ot.main - 235][INFO] - LOGNORM eseguito correttamente.
2025.03.11-15:53:37 [ot.main - 236][DEBUG] - Output LOGNORM:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-15:53:37 [ot.algoritmi.__call__ - 234][INFO] - Eseguo algoritmo skimage.registration.optical_flow_ilk
2025.03.11-15:53:37 [ot.algoritmi.__call__ - 235][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-15:53:37 [ot.algoritmi.__call__ - 236][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('uint8')
2025.03.11-15:54:51 [ot.algoritmi.__call__ - 242][DEBUG] - Numero output: 2
2025.03.11-15:54:51 [ot.algoritmi.__call__ - 243][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
```

```
2025.03.11-15:54:51 [ot.algoritmi.__call__ - 244][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-15:54:52 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowILK eseguito correttamente
2025.03.11-15:54:52 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-ilk.lognorm.tiff
2025.03.11-15:54:52 [ot._summary_statistics - 194][DEBUG] -               OT Media:  0.275
2025.03.11-15:54:52 [ot._summary_statistics - 195][DEBUG] -             OT Mediana:  0.148
2025.03.11-15:54:52 [ot._summary_statistics - 196][DEBUG] -                 OT STD:  5.72
2025.03.11-15:54:52 [ot._summary_statistics - 197][DEBUG] -              OT Minimo:  0
2025.03.11-15:54:52 [ot._summary_statistics - 198][DEBUG] -             OT Massimo:  8.78e+03
2025.03.11-15:54:53 [ot._summary_statistics - 199][DEBUG] -           OT 25° perc.:  0
2025.03.11-15:54:53 [ot._summary_statistics - 200][DEBUG] -           OT 75° perc.:  0.333
2025.03.11-15:54:53 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-ilk.lognorm.tiff
{'attachment': 10, 'tightness': 0.3, 'num_warp': 3, 'num_iter': 10, 'tol': 0.0001, 'prefilter': False}
2025.03.11-15:54:54 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowTVL1_parms.json
2025.03.11-15:54:54 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowTVL1
2025.03.11-15:54:54 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-15:54:54 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-15:54:54 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:54:54 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-15:54:59 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-15:54:59 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-15:55:04 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-15:55:04 [ot.main - 229][INFO] - Applicazione MINMAX mediante libreria skimage
2025.03.11-15:55:04 [ot.image_processing.ski.minmax - 123][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:55:04 [ot.main - 229][INFO] - Applicazione MINMAX mediante libreria skimage
2025.03.11-15:55:04 [ot.image_processing.ski.minmax - 123][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-15:55:04 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-15:55:04 [ot.main - 235][INFO] - MINMAX eseguito correttamente.
2025.03.11-15:55:04 [ot.main - 236][DEBUG] - Output MINMAX:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-15:55:04 [ot.algoritmi.__call__ - 273][INFO] - Eseguo algoritmo skimage.registration.optical_flow_tvl1
2025.03.11-15:55:04 [ot.algoritmi.__call__ - 274][DEBUG] - reference.image.shape = (6000, 10000), reference.image.dtype =
```

```
dtype('uint8')
2025.03.11-15:55:04 [ot.algoritmi.__call__ - 275][DEBUG] - target.image.shape = (6000, 10000), target.image.dtype =
dtype('uint8')
2025.03.11-15:59:59 [ot.algoritmi.__call__ - 286][DEBUG] - Numero output: 2
2025.03.11-15:59:59 [ot.algoritmi.__call__ - 287][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-15:59:59 [ot.algoritmi.__call__ - 288][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-16:00:00 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowTVL1 eseguito correttamente
2025.03.11-16:00:00 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-tvl1.minmax.tiff
2025.03.11-16:00:00 [ot._summary_statistics - 194][DEBUG] -               OT Media:  0.257
2025.03.11-16:00:00 [ot._summary_statistics - 195][DEBUG] -             OT Mediana:  0.157
2025.03.11-16:00:00 [ot._summary_statistics - 196][DEBUG] -                 OT STD:  0.272
2025.03.11-16:00:01 [ot._summary_statistics - 197][DEBUG] -              OT Minimo:  2.98e-05
2025.03.11-16:00:01 [ot._summary_statistics - 198][DEBUG] -             OT Massimo:  4.72
2025.03.11-16:00:01 [ot._summary_statistics - 199][DEBUG] -           OT 25° perc.:  0.109
2025.03.11-16:00:01 [ot._summary_statistics - 200][DEBUG] -           OT 75° perc.:  0.271
2025.03.11-16:00:01 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-tvl1.minmax.tiff
{'attachment': 10, 'tightness': 0.3, 'num_warp': 3, 'num_iter': 10, 'tol': 0.0001, 'prefilter': False}
2025.03.11-16:00:02 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowTVL1_parms.json
2025.03.11-16:00:02 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowTVL1
2025.03.11-16:00:02 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:00:02 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:00:02 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:00:02 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:00:07 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:00:07 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:00:13 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:00:13 [ot.main - 229][INFO] - Applicazione ZSCORE mediante libreria skimage
2025.03.11-16:00:13 [ot.image_processing.ski.zscore - 109][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-16:00:13 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:00:13 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:00:13 [ot.main - 229][INFO] - Applicazione ZSCORE mediante libreria skimage
2025.03.11-16:00:13 [ot.image_processing.ski.zscore - 109][INFO] - Eseguo trasformata `zscore` con metodi skimage
2025.03.11-16:00:13 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:00:13 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:00:14 [ot.main - 235][INFO] - ZSCORE eseguito correttamente.
2025.03.11-16:00:14 [ot.main - 236][DEBUG] - Output ZSCORE:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:00:14 [ot.algoritmi.__call__ - 273][INFO] - Eseguo algoritmo skimage.registration.optical_flow_tvl1
2025.03.11-16:00:14 [ot.algoritmi.__call__ - 274][DEBUG] - reference.image.shape = (6000, 10000), reference.image.dtype =
dtype('float64')
```

```
2025.03.11-16:00:14 [ot.algoritmi.__call__ - 275][DEBUG] - target.image.shape = (6000, 10000), target.image.dtype =
dtype('float64')
2025.03.11-16:05:26 [ot.algoritmi.__call__ - 286][DEBUG] - Numero output: 2
2025.03.11-16:05:26 [ot.algoritmi.__call__ - 287][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-16:05:26 [ot.algoritmi.__call__ - 288][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-16:05:27 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowTVL1 eseguito correttamente
2025.03.11-16:05:27 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-tvl1.zscore.tiff
2025.03.11-16:05:27 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.398
2025.03.11-16:05:27 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.311
2025.03.11-16:05:27 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.364
2025.03.11-16:05:27 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  1.15e-05
2025.03.11-16:05:27 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  34.6
2025.03.11-16:05:28 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  0.156
2025.03.11-16:05:28 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.571
2025.03.11-16:05:28 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-tvl1.zscore.tiff
{'attachment': 10, 'tightness': 0.3, 'num_warp': 3, 'num_iter': 10, 'tol': 0.0001, 'prefilter': False}
2025.03.11-16:05:29 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowTVL1_parms.json
2025.03.11-16:05:29 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowTVL1
2025.03.11-16:05:29 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:05:29 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:05:29 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:05:29 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:05:34 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:05:34 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:05:40 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:05:40 [ot.main - 229][INFO] - Applicazione CLAHE mediante libreria skimage
2025.03.11-16:05:40 [ot.image_processing.ski.clahe - 86][INFO] - Eseguo skimage.exposure.equalize_adapthist
2025.03.11-16:05:40 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:05:40 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:05:40 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:05:40 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:05:54 [ot.main - 229][INFO] - Applicazione CLAHE mediante libreria skimage
2025.03.11-16:05:54 [ot.image_processing.ski.clahe - 86][INFO] - Eseguo skimage.exposure.equalize_adapthist
2025.03.11-16:05:54 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:05:54 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:05:54 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:05:54 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
```

```
2025.03.11-16:06:09 [ot.main - 235][INFO] - CLAHE eseguito correttamente.
2025.03.11-16:06:09 [ot.main - 236][DEBUG] - Output CLAHE:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:06:09 [ot.algoritmi.__call__ - 273][INFO] - Eseguo algoritmo skimage.registration.optical_flow_tvl1
2025.03.11-16:06:09 [ot.algoritmi.__call__ - 274][DEBUG] - reference.image.shape = (6000, 10000), reference.image.dtype =
dtype('float64')
2025.03.11-16:06:09 [ot.algoritmi.__call__ - 275][DEBUG] - target.image.shape = (6000, 10000), target.image.dtype =
dtype('float64')
2025.03.11-16:11:06 [ot.algoritmi.__call__ - 286][DEBUG] - Numero output: 2
2025.03.11-16:11:06 [ot.algoritmi.__call__ - 287][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-16:11:06 [ot.algoritmi.__call__ - 288][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-16:11:07 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowTVL1 eseguito correttamente
2025.03.11-16:11:07 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-tvl1.clahe.tiff
2025.03.11-16:11:07 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.452
2025.03.11-16:11:07 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.245
2025.03.11-16:11:07 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.438
2025.03.11-16:11:07 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  3.55e-05
2025.03.11-16:11:07 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  4.73
2025.03.11-16:11:08 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  0.133
2025.03.11-16:11:08 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.716
2025.03.11-16:11:08 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-tvl1.clahe.tiff
{'attachment': 10, 'tightness': 0.3, 'num_warp': 3, 'num_iter': 10, 'tol': 0.0001, 'prefilter': False}
2025.03.11-16:11:09 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: SkiOpticalFlowTVL1_parms.json
2025.03.11-16:11:09 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO SkiOpticalFlowTVL1
2025.03.11-16:11:09 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:11:09 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:11:09 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:11:09 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:11:14 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:11:14 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:11:20 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:11:20 [ot.main - 229][INFO] - Applicazione LOGNORM mediante libreria skimage
2025.03.11-16:11:20 [ot.image_processing.ski.lognorm - 96][INFO] - Eseguo skimage.exposure.adjust_log
2025.03.11-16:11:20 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:11:20 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:11:20 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:11:20 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:11:21 [ot.main - 229][INFO] - Applicazione LOGNORM mediante libreria skimage
2025.03.11-16:11:21 [ot.image_processing.ski.lognorm - 96][INFO] - Eseguo skimage.exposure.adjust_log
2025.03.11-16:11:21 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
```

```
array.dtype=dtype('uint8')
2025.03.11-16:11:21 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:11:21 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:11:21 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:11:21 [ot.main - 235][INFO] - LOGNORM eseguito correttamente.
2025.03.11-16:11:21 [ot.main - 236][DEBUG] - Output LOGNORM:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:11:21 [ot.algoritmi.__call__ - 273][INFO] - Eseguo algoritmo skimage.registration.optical_flow_tvl1
2025.03.11-16:11:21 [ot.algoritmi.__call__ - 274][DEBUG] - reference.image.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-16:11:21 [ot.algoritmi.__call__ - 275][DEBUG] - target.image.shape = (6000, 10000), target.image.dtype =
dtype('uint8')
2025.03.11-16:16:15 [ot.algoritmi.__call__ - 286][DEBUG] - Numero output: 2
2025.03.11-16:16:15 [ot.algoritmi.__call__ - 287][DEBUG] - Tipo output: [<class 'numpy.ndarray'>, <class 'numpy.ndarray'>]
2025.03.11-16:16:15 [ot.algoritmi.__call__ - 288][DEBUG] - Shape output: [(6000, 10000), (6000, 10000)]
2025.03.11-16:16:16 [ot.main - 242][INFO] - Algoritmo SkiOpticalFlowTVL1 eseguito correttamente
2025.03.11-16:16:16 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_ski-tvl1.lognorm.tiff
2025.03.11-16:16:16 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.256
2025.03.11-16:16:16 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.158
2025.03.11-16:16:16 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.264
2025.03.11-16:16:16 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  4.69e-05
2025.03.11-16:16:16 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  5.14
2025.03.11-16:16:17 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  0.109
2025.03.11-16:16:17 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.275
2025.03.11-16:16:17 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_ski-tvl1.lognorm.tiff
{'flow': None, 'pyr_scale': 0.5, 'levels': 4, 'winsize': 4, 'iterations': 10, 'poly_n': 5, 'poly_sigma': 1.1, 'flags': None}
2025.03.11-16:16:18 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: OpenCVOpticalFlow_parms.json
2025.03.11-16:16:18 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO OpenCVOpticalFlow
2025.03.11-16:16:18 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:16:18 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:16:18 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:16:18 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:16:23 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:16:23 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:16:29 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:16:29 [ot.main - 229][INFO] - Applicazione LOGNORM mediante libreria OpenCV
2025.03.11-16:16:29 [ot.image_processing.opencv.lognorm - 53][INFO] - Eseguo trasformazione logaritmica con metodi OpenCV
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
```

```
array.dtype=dtype('uint8')
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:16:29 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:16:29 [ot.image_processing.opencv.lognorm - 58][DEBUG] - Converto il formato in ingresso in cv2.CV_32F=5 prima
della trasformazione logaritmica
2025.03.11-16:16:29 [ot.image_processing.common._normalize - 58][DEBUG] - Normalizzo immagine in range: (0,1). Normalizzazione:
cv2.NORM_MINMAX=32. Formato in uscita: 5
2025.03.11-16:16:29 [ot.image_processing.common._normalize - 58][DEBUG] - Normalizzo immagine in range: (0,255). Normalizzazione:
cv2.NORM_MINMAX=32. Formato in uscita: 0
2025.03.11-16:16:29 [ot.main - 229][INFO] - Applicazione LOGNORM mediante libreria OpenCV
2025.03.11-16:16:29 [ot.image_processing.opencv.lognorm - 53][INFO] - Eseguo trasformazione logaritmica con metodi OpenCV
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:16:29 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:16:29 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:16:29 [ot.image_processing.opencv.lognorm - 58][DEBUG] - Converto il formato in ingresso in cv2.CV_32F=5 prima
della trasformazione logaritmica
2025.03.11-16:16:29 [ot.image_processing.common._normalize - 58][DEBUG] - Normalizzo immagine in range: (0,1). Normalizzazione:
cv2.NORM_MINMAX=32. Formato in uscita: 5
2025.03.11-16:16:29 [ot.image_processing.common._normalize - 58][DEBUG] - Normalizzo immagine in range: (0,255). Normalizzazione:
cv2.NORM_MINMAX=32. Formato in uscita: 0
2025.03.11-16:16:29 [ot.main - 235][INFO] - LOGNORM eseguito correttamente.
2025.03.11-16:16:29 [ot.main - 236][DEBUG] - Output LOGNORM:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:16:29 [ot.algoritmi.__call__ - 193][INFO] - Eseguo algoritmo cv2.calcOpticalFlowFarneback
2025.03.11-16:16:29 [ot.algoritmi.__call__ - 194][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-16:16:29 [ot.algoritmi.__call__ - 195][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('uint8')
2025.03.11-16:16:49 [ot.algoritmi.__call__ - 209][DEBUG] - Tipo output: float32
2025.03.11-16:16:49 [ot.algoritmi.__call__ - 210][DEBUG] - Shape output: (6000, 10000)
2025.03.11-16:16:49 [ot.main - 242][INFO] - Algoritmo OpenCVOpticalFlow eseguito correttamente
2025.03.11-16:16:49 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_opencv.lognorm.tiff
2025.03.11-16:16:49 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.369
2025.03.11-16:16:49 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.19
2025.03.11-16:16:49 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.698
2025.03.11-16:16:49 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  0
2025.03.11-16:16:49 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  82.8
2025.03.11-16:16:50 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  1.17e-09
2025.03.11-16:16:50 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.467
2025.03.11-16:16:50 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_opencv.lognorm.tiff
{'flow': None, 'pyr_scale': 0.5, 'levels': 4, 'winsize': 4, 'iterations': 10, 'poly_n': 5, 'poly_sigma': 1.1, 'flags': None}
```

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2025.03.11-16:16:51 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: OpenCVOpticalFlow_parms.json
2025.03.11-16:16:51 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO OpenCVOpticalFlow
2025.03.11-16:16:51 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:16:51 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:16:51 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:16:51 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:16:56 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:16:56 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:17:01 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:17:01 [ot.main - 229][INFO] - Applicazione MINMAX mediante libreria OpenCV
2025.03.11-16:17:01 [ot.image_processing.opencv.minmax - 80][INFO] - Scalo le intensità sui valori minimo/massimo con metodi
OpenCV
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:01 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:17:01 [ot.main - 229][INFO] - Applicazione MINMAX mediante libreria OpenCV
2025.03.11-16:17:01 [ot.image_processing.opencv.minmax - 80][INFO] - Scalo le intensità sui valori minimo/massimo con metodi
OpenCV
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:01 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:01 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:17:02 [ot.main - 235][INFO] - MINMAX eseguito correttamente.
2025.03.11-16:17:02 [ot.main - 236][DEBUG] - Output MINMAX:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:17:02 [ot.algoritmi.__call__ - 193][INFO] - Eseguo algoritmo cv2.calcOpticalFlowFarneback
2025.03.11-16:17:02 [ot.algoritmi.__call__ - 194][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-16:17:02 [ot.algoritmi.__call__ - 195][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('uint8')
2025.03.11-16:17:22 [ot.algoritmi.__call__ - 209][DEBUG] - Tipo output: float32
2025.03.11-16:17:22 [ot.algoritmi.__call__ - 210][DEBUG] - Shape output: (6000, 10000)
2025.03.11-16:17:22 [ot.main - 242][INFO] - Algoritmo OpenCVOpticalFlow eseguito correttamente
2025.03.11-16:17:22 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_opencv.minmax.tiff
```

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2025.03.11-16:17:22 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.374
2025.03.11-16:17:22 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.197
2025.03.11-16:17:22 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.695
2025.03.11-16:17:22 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  0
2025.03.11-16:17:23 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  98.3
2025.03.11-16:17:23 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  1.29e-09
2025.03.11-16:17:23 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.481
2025.03.11-16:17:23 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_opencv.minmax.tiff
{'flow': None, 'pyr_scale': 0.5, 'levels': 4, 'winsize': 4, 'iterations': 10, 'poly_n': 5, 'poly_sigma': 1.1, 'flags': None}
2025.03.11-16:17:24 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: OpenCVOpticalFlow_parms.json
2025.03.11-16:17:24 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO OpenCVOpticalFlow
2025.03.11-16:17:24 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:17:24 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:17:24 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:17:24 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:17:29 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:17:29 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:17:34 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:17:34 [ot.main - 229][INFO] - Applicazione ZSCORE mediante libreria OpenCV
2025.03.11-16:17:34 [ot.image_processing.opencv.zscore - 68][INFO] - Applico la trasformata zscore con metodi OpenCV
2025.03.11-16:17:34 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:34 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:34 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:17:35 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:35 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:35 [ot.image_processing.common._normalize - 58][DEBUG] - Normalizzo immagine in range: (0,255). Normalizzazione:
cv2.NORM_MINMAX=32. Formato in uscita: 0
2025.03.11-16:17:35 [ot.main - 229][INFO] - Applicazione ZSCORE mediante libreria OpenCV
2025.03.11-16:17:35 [ot.image_processing.opencv.zscore - 68][INFO] - Applico la trasformata zscore con metodi OpenCV
2025.03.11-16:17:35 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:35 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:35 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:17:35 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:17:35 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:17:36 [ot.image_processing.common._normalize - 58][DEBUG] - Normalizzo immagine in range: (0,255). Normalizzazione:
```

```
cv2.NORM_MINMAX=32. Formato in uscita: 0
2025.03.11-16:17:36 [ot.main - 235][INFO] - ZSCORE eseguito correttamente.
2025.03.11-16:17:36 [ot.main - 236][DEBUG] - Output ZSCORE:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:17:36 [ot.algoritmi.__call__ - 193][INFO] - Eseguo algoritmo cv2.calcOpticalFlowFarneback
2025.03.11-16:17:36 [ot.algoritmi.__call__ - 194][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-16:17:36 [ot.algoritmi.__call__ - 195][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('uint8')
2025.03.11-16:17:55 [ot.algoritmi.__call__ - 209][DEBUG] - Tipo output: float32
2025.03.11-16:17:55 [ot.algoritmi.__call__ - 210][DEBUG] - Shape output: (6000, 10000)
2025.03.11-16:17:55 [ot.main - 242][INFO] - Algoritmo OpenCVOpticalFlow eseguito correttamente
2025.03.11-16:17:55 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_opencv.zscore.tiff
2025.03.11-16:17:55 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.374
2025.03.11-16:17:55 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.197
2025.03.11-16:17:55 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.695
2025.03.11-16:17:56 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  0
2025.03.11-16:17:56 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  98.3
2025.03.11-16:17:56 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  1.29e-09
2025.03.11-16:17:56 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.481
2025.03.11-16:17:56 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_opencv.zscore.tiff
{'flow': None, 'pyr_scale': 0.5, 'levels': 4, 'winsize': 4, 'iterations': 10, 'poly_n': 5, 'poly_sigma': 1.1, 'flags': None}
2025.03.11-16:17:57 [ot.interfaces.toJSON - 245][INFO] - Esporto parametri su file: OpenCVOpticalFlow_parms.json
2025.03.11-16:17:57 [ot.main - 216][INFO] - AVVIO ANALISI OT CON METODO OpenCVOpticalFlow
2025.03.11-16:17:57 [ot.load_images - 141][INFO] - REFERENCE: HSD_2019.tiff
2025.03.11-16:17:57 [ot.load_images - 142][INFO] - TARGET: HSD_2021.tiff
2025.03.11-16:17:57 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:17:57 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
019.tiff con rasterio.
2025.03.11-16:18:02 [ot.utils.rasterio_read - 96][INFO] - Caricamento dataset raster
2025.03.11-16:18:02 [ot.utils.rasterio_read - 97][DEBUG] - Caricamento
W:\SoLoMon\Siti\Corvara\DEM\LiDAR_HELICA_2019_2022\Elaborazioni_UNIMORE\IRIS_corvara_2022\Elaborazione_HSD_NCC\processing_2\HSD_2
021.tiff con rasterio.
2025.03.11-16:18:08 [ot.load_images - 188][INFO] - Immagini raster già coregistrate.
2025.03.11-16:18:08 [ot.main - 229][INFO] - Applicazione CLAHE mediante libreria OpenCV
2025.03.11-16:18:08 [ot.image_processing.opencv.clahe - 24][INFO] - Eseguo CLAHE con metodi OpenCV
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:18:08 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:18:08 [ot.image_processing.opencv.clahe - 31][DEBUG] - Finestra mobile: kernel_size=(3, 3)
2025.03.11-16:18:08 [ot.main - 229][INFO] - Applicazione CLAHE mediante libreria OpenCV
```

```
2025.03.11-16:18:08 [ot.image_processing.opencv.clahe - 24][INFO] - Eseguo CLAHE con metodi OpenCV
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 19][DEBUG] - array.shape=(6000, 10000)
array.dtype=dtype('uint8')
2025.03.11-16:18:08 [ot.image_processing.common._array_verbose - 20][DEBUG] - array.min()=np.uint8(0) array.max()=np.uint8(255)
2025.03.11-16:18:08 [ot.image_processing.common._overwrite_nodata - 81][DEBUG] - Valori pari a -9999.0 intesi come valori NULLI
(sovrascritti come DEFAULT_NODATA)
2025.03.11-16:18:08 [ot.image_processing.opencv.clahe - 31][DEBUG] - Finestra mobile: kernel_size=(3, 3)
2025.03.11-16:18:08 [ot.main - 235][INFO] - CLAHE eseguito correttamente.
2025.03.11-16:18:08 [ot.main - 236][DEBUG] - Output CLAHE:[<class 'ot.interfaces.Image'>, <class 'ot.interfaces.Image'>]
2025.03.11-16:18:08 [ot.algoritmi.__call__ - 193][INFO] - Eseguo algoritmo cv2.calcOpticalFlowFarneback
2025.03.11-16:18:08 [ot.algoritmi.__call__ - 194][DEBUG] - reference.shape = (6000, 10000), reference.image.dtype =
dtype('uint8')
2025.03.11-16:18:08 [ot.algoritmi.__call__ - 195][DEBUG] - target.shape = (6000, 10000), target.image.dtype = dtype('uint8')
2025.03.11-16:18:28 [ot.algoritmi.__call__ - 209][DEBUG] - Tipo output: float32
2025.03.11-16:18:28 [ot.algoritmi.__call__ - 210][DEBUG] - Shape output: (6000, 10000)
2025.03.11-16:18:28 [ot.main - 242][INFO] - Algoritmo OpenCVOpticalFlow eseguito correttamente
2025.03.11-16:18:28 [ot.main - 244][INFO] - Esporto su file: CV_2019-2021_opencv.clahe.tiff
2025.03.11-16:18:28 [ot._summary_statistics - 194][DEBUG] -              OT Media:  0.377
2025.03.11-16:18:28 [ot._summary_statistics - 195][DEBUG] -            OT Mediana:  0.203
2025.03.11-16:18:28 [ot._summary_statistics - 196][DEBUG] -                OT STD:  0.641
2025.03.11-16:18:28 [ot._summary_statistics - 197][DEBUG] -             OT Minimo:  0
2025.03.11-16:18:28 [ot._summary_statistics - 198][DEBUG] -            OT Massimo:  97.2
2025.03.11-16:18:29 [ot._summary_statistics - 199][DEBUG] -          OT 25° perc.:  4.29e-09
2025.03.11-16:18:29 [ot._summary_statistics - 200][DEBUG] -          OT 75° perc.:  0.496
2025.03.11-16:18:29 [ot.write_output - 106][DEBUG] - File esportato: CV_2019-2021_opencv.clahe.tiff
```