Custom Analysis using Raster Cell Iterator

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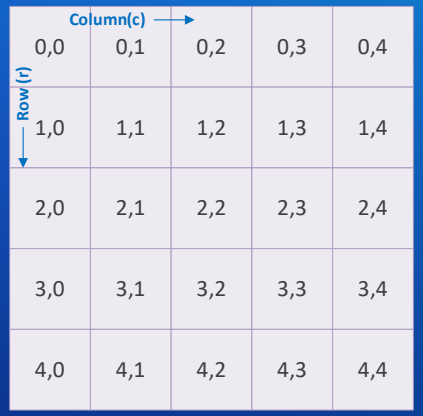
What is Raster Cell Iterator (RCI)?

- RCI allows you to visit each cell in a raster
- You can refer to a cell using its location by index in a `Raster` object
- The index starts from 0
- You can read a cell value
- You can assign a cell value
  - Set `Raster.readOnly` property to False
  - Save the raster using `Raster.save()` method




```
## Getting cell values
in_ras = Raster("myRaster")
for r,c in in_ras:
    cell_value = in_ras[r,c]
```

Neighborhood Notation

- While visiting a cell, you can use relative indices to access the surrounding cells
- This capability is useful for custom focal analysis

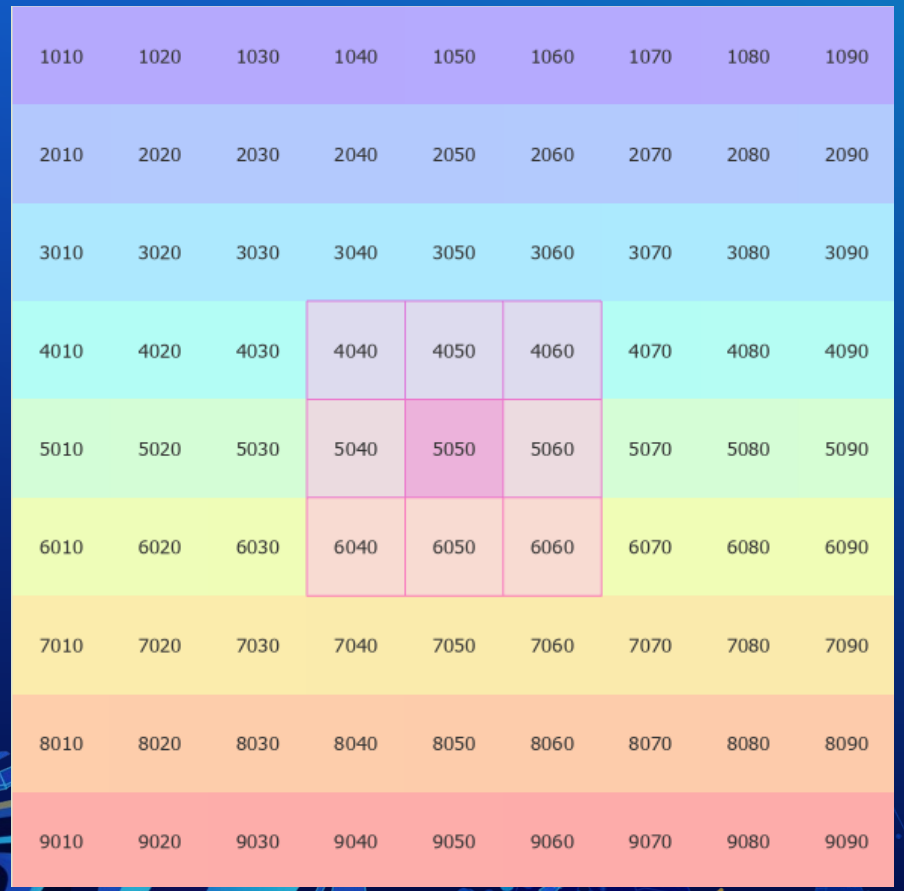
Column(c) → / Row(r) ↓				
0,0	0,1	0,2	0,3	0,4
1,0	1,1	1,2	1,3	1,4
2,0	2,1	2,2	2,3	2,4
3,0	3,1	3,2	3,3	3,4
4,0	4,1	4,2	4,3	4,4

r-2,c-2	r-2,c-1	r-2,c	r-2,c+1	r-2,c+2
r-1,c-2	r-1,c-1	r-1,c	r-1,c+1	r-1,c+2
r,c-2	r,c-1	**r,c**	r,c+1	r,c+2
r+1,c-2	r+1,c-1	r+1,c	r+1,c+1	r+1,c+2
r+2,c-2	r+2,c-1	r+2,c	r+2,c+1	r+2,c+2

```
for r,c in in_ras:
    UL_cell_value = in_ras[r-1,c-1]
    UC_cell_value = in_ras[r-1,  c]
    UR_cell_value = in_ras[r-1,c+1]

    CL_cell_value = in_ras[r,c-1]
    CC_cell_value = in_ras[r,  c]
    CR_cell_value = in_ras[r,c+1]

    LL_cell_value = in_ras[r+1,c-1]
    LC_cell_value = in_ras[r+1,  c]
    LR_cell_value = in_ras[r+1,c+1]
```



Iterating Cells in a Raster

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RasterCellIterator Class

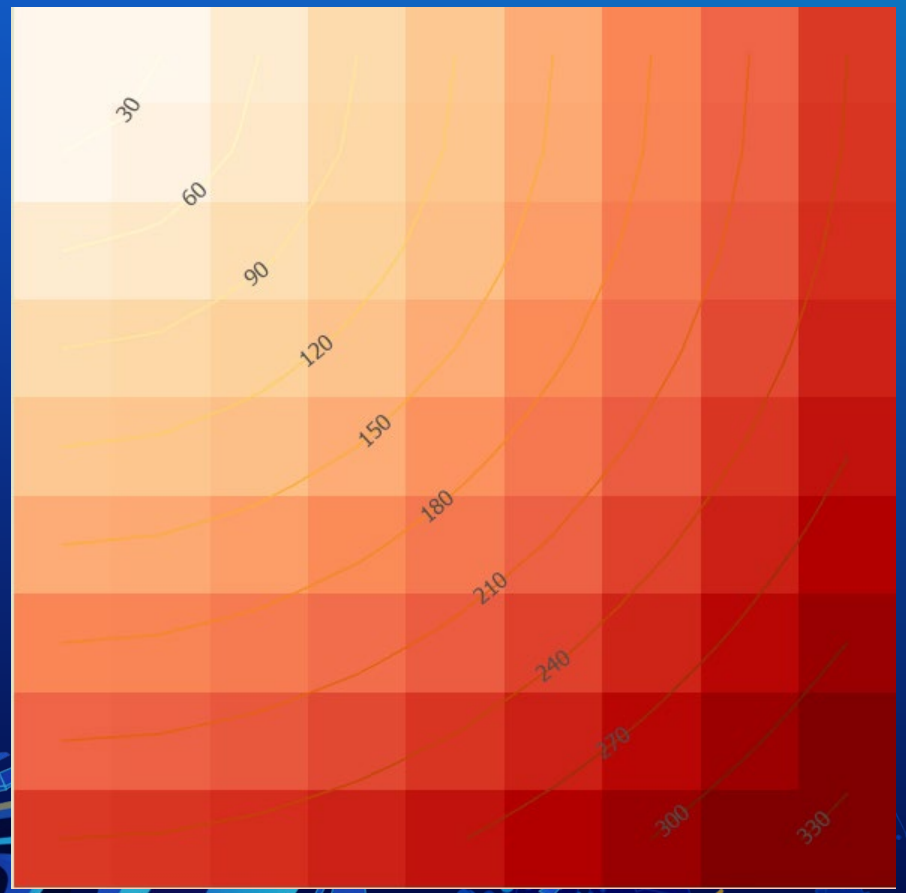
- Defines an iterator object to iterate through the cells of one or more rasters.
- It is an explicit iterator, useful for iterating through multiple rasters while performing analysis using one or more inputs and creating output(s).
- The `rasters` key indicates the list of input and output rasters.
- The `padding` key lets you define a padding factor to improve the performance for accessing neighboring cells
- The `skipNoData` key lets the iterator skip the NoData cells automatically. Useful for processing raster representing discrete features like roads, rivers, etc.

```
RasterCellIterator({'rasters': [in_rasterobj1, in_rasterobj2, ...],
                    'padding': padding_factor,
                    'skipNoData': [in_rasterobj1, in_rasterobj2, ...]})
```

Creating a New Raster Filled with NoData

- Create `Raster` object using `RasterInfo` object as an argument.
- You can create an empty `RasterInfo` object and set necessary properties.
- You can also get a `RasterInfo` object from an existing raters using `Raster.getRasterInfo()` method to use it as a template.
  - Update the new raster specific properties such as pixel type.
- Save the new raster using `Raster.save()` method

```
in_ras = Raster("myRaster")
ras_info = in_ras.getRasterInfo()
ras_info.setPixelType("F32")
out_new_ras = Raster(ras_info)
```



RasterCellIterator in Action

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Contour Curvature: Custom Analysis using Finite Difference Approximation

$$K_C = -\frac{f_{xx}f_y^2 - 2f_{xy}f_xf_y + f_{yy}f_x^2}{\left(f_x^2 + f_y^2\right)^{3/2}}$$

$$f_x = (z6 - z4) \,/\, 2 * cs$$

$$f_y = (z8 - z2) \,/\, 2 * cs$$

$$f_{xx} = (z6 + z4 - 2 * z5) \,/\, cs^2$$

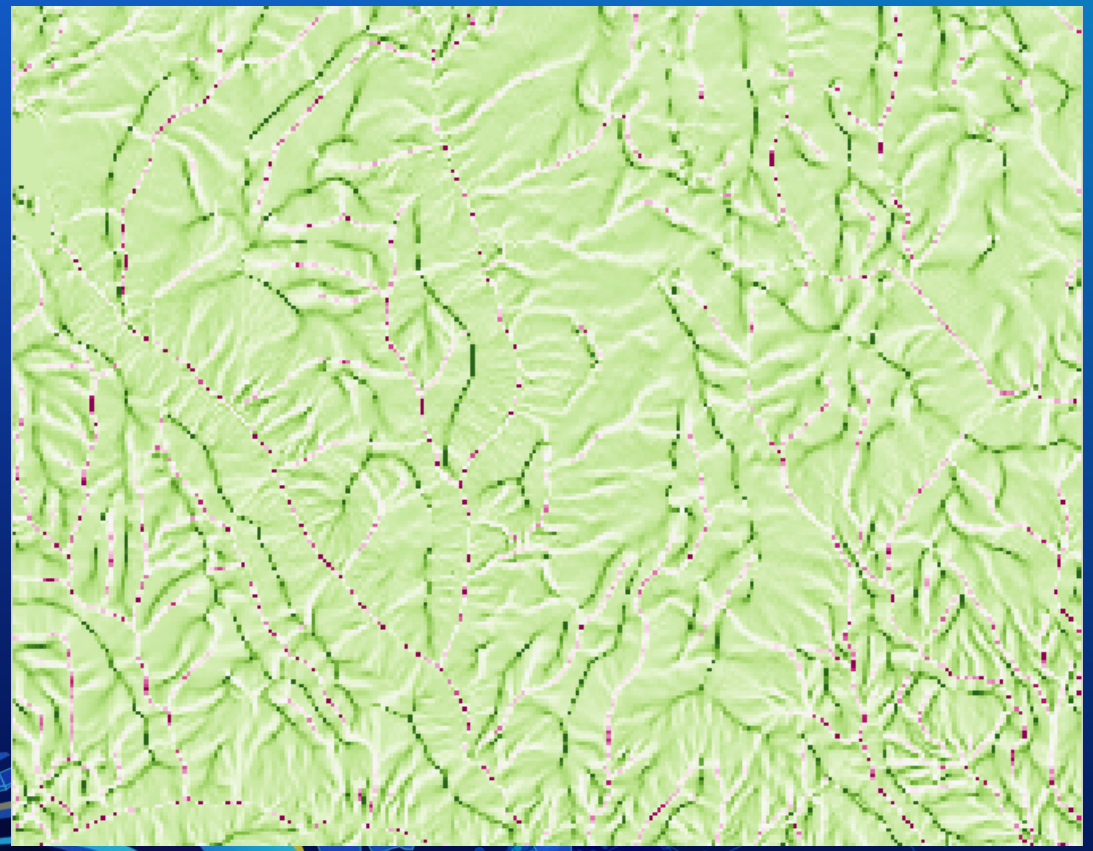
$$f_{yy} = (z8 + z2 - 2 * z5) \,/\, cs^2$$

$$f_{xy} = (z9 - z7 - z3 + z1) \,/\, (4 * cs^2)$$

z1 *r-1,c-1*	*z2* *r-1,c*	*z3* *r-1,c+1*
z4 *r,c-1*	*z5* *r,c*	*z6* *r,c+1*
z7 *r+1,c-1*	*z8* *r+1,c*	*z9* *r+1,c+1*

z1, z2,… = Cell values
cs = Cell size

Schmidt, Jochen, Ian S. Evans, and Johannes Brinkmann. “Comparison of Polynomial Models for Land Surface Curvature Calculation.” International Journal of Geographical Information Science 17, no. 8 (December 2003): 797–814. https://doi.org/10.1080/1365810310001596058.



Custom Analysis

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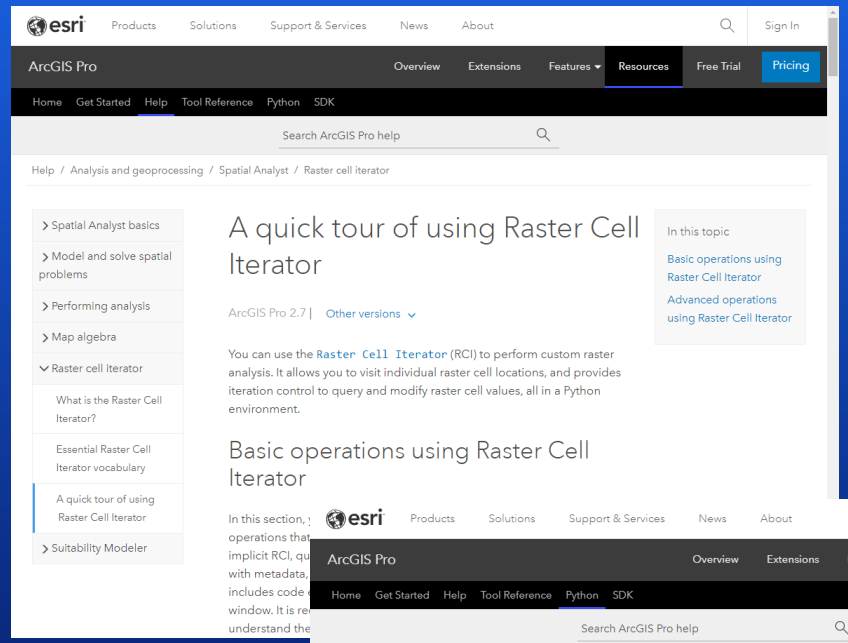
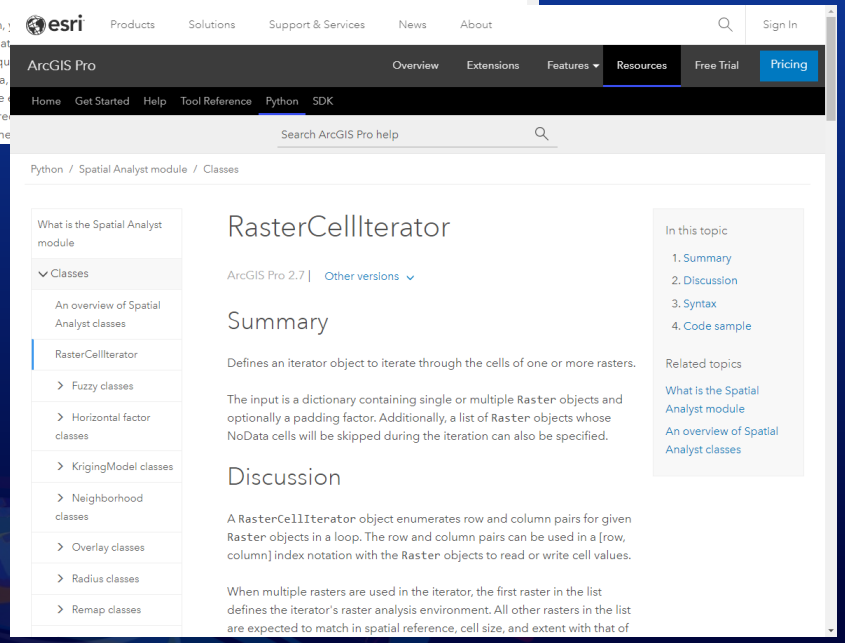
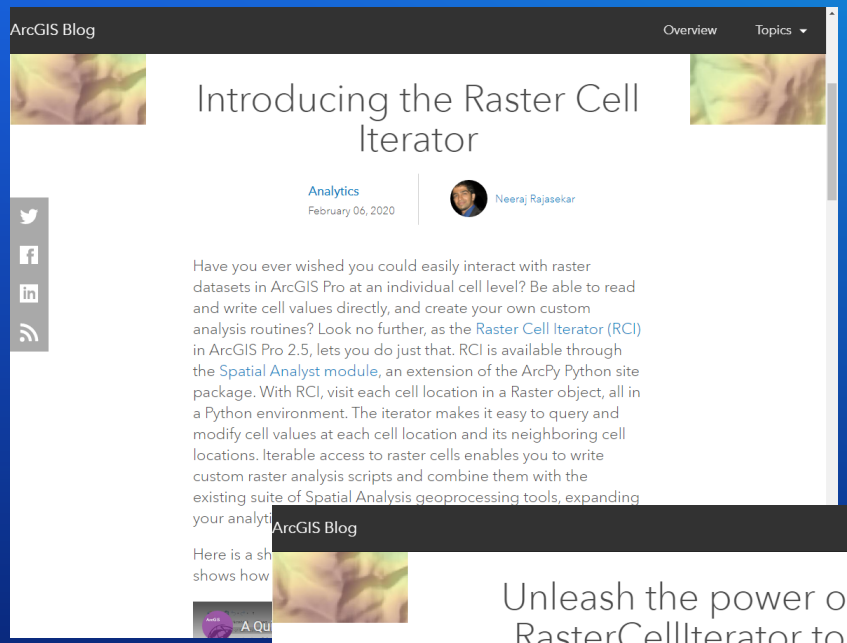
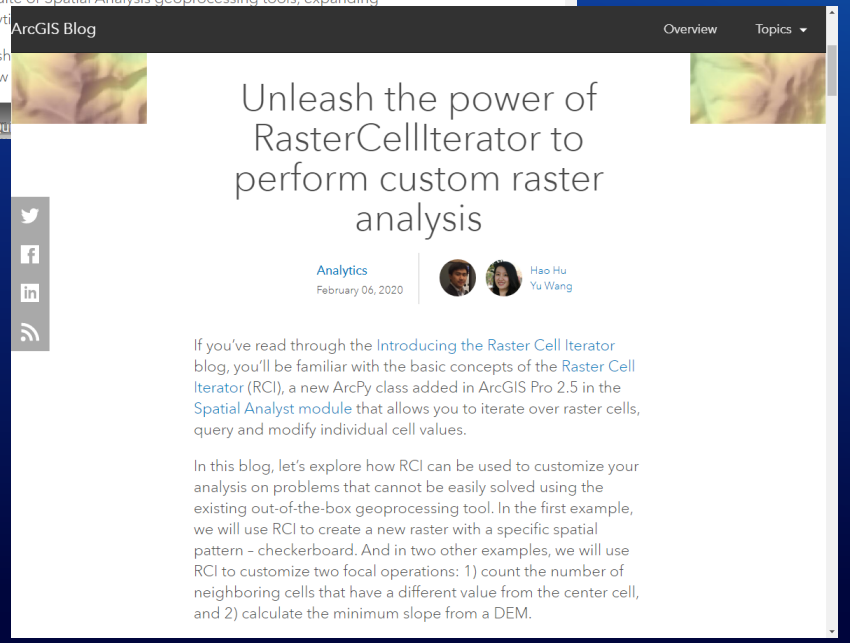
Additional Resources









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