# Input data:

* bankLine1 and bankLine2: x and y coordinates of the points on bank lines (2-column matrix)
* cross-section lines: several lines with position and elevation values (a cell of 3-column matrixes)
* river channel polygon: connect the two bank lines to be a closed polygon

# Data pre-processing: check the direction of lines

* Points on the two bank lines should be listed towards the same direction (upstream or downstream)
* Points on each cross-section line should be listed towards the same direction (bank1 to bank2)
* Cross-section lines should be listed towards the same direction of bank lines (upstream or downstream)
* The parts of cross-section lines outside the channel should be cut

# Main process

## River channel segmentation

* split channel polygon to sections based on cross section lines

Output: **river channel sections**

## Linearization of channel sections (for each section)

* Linearize the two bank lines under a given error value and get the break points in each bank line
* Project the break points to the opposite bank line and get a series of paired break points and connect the paired-points to be cutting lines
* Divide the channel section into linearized subsections (consisting of quadrangles and triangles) based on the cutting lines
* Calculate the elevation of cutting lines based on the position of the middle point of cutting line and the two cross section lines for this section.

Output: **river channel subsection and cutting lines**

## Discretization of channel subsections (for each subsection)

* Build a new relative coordinate system (b, c), b means the length ratio along bank line, c means the length ratio along cross-section or cutting line.
* Discretize the subsection area to grids on b-c coordinate system (the density of the grids could be maximized to the cell size of DEM)
* Use 1-D interpolation to get the x-y coordinates and elevation (v) of the grids located on the starting and ending cross-section/cutting lines of the subsection.
* Get the elevation (v) value of grids based on the b-c-v coordinate of the grids on cross-section line or cutting lines
* Get the x-y coordinates of grids based on the x-y coordinate of the grids on cross-section line or cutting line

Output: **scatters with b-c-v and x-y-v coordinates inside the channel subsection**

## Interpolation for river channel raster

Create river channel raster based on river channel polygon

Interpolate elevation value subsection by subsection from b-c grids to x-y raster points