Multi-spectral

Include Only If Paper Has a Subtitle

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Evolutionary algorithms, 2013

Outline

1. Problem description
   - Classification
   - Algorithm
2. Results

Classification

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- Unsupervised classification - we just wait for it to do the work

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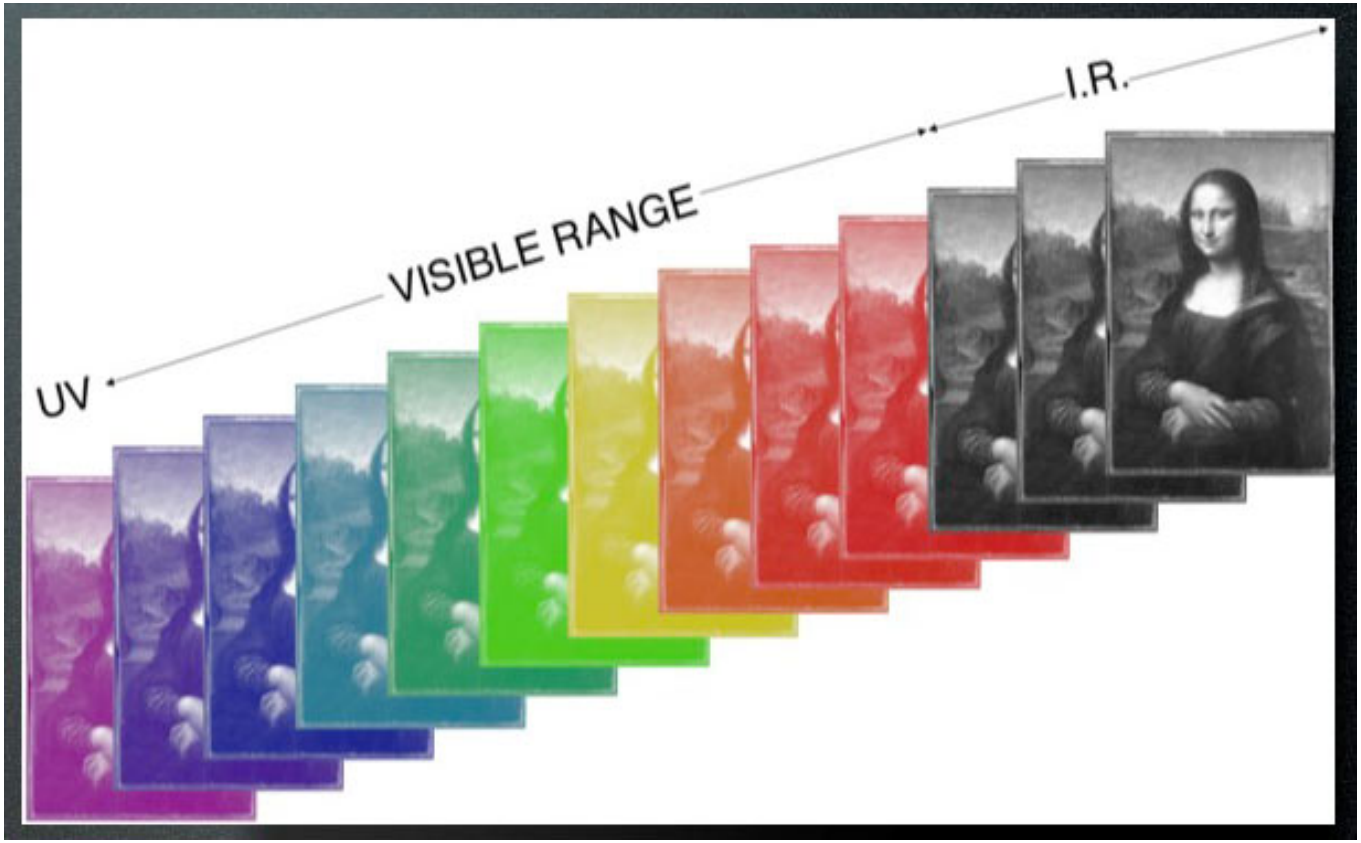
Data



LANDSAT 7 pictures (5-8 bands)

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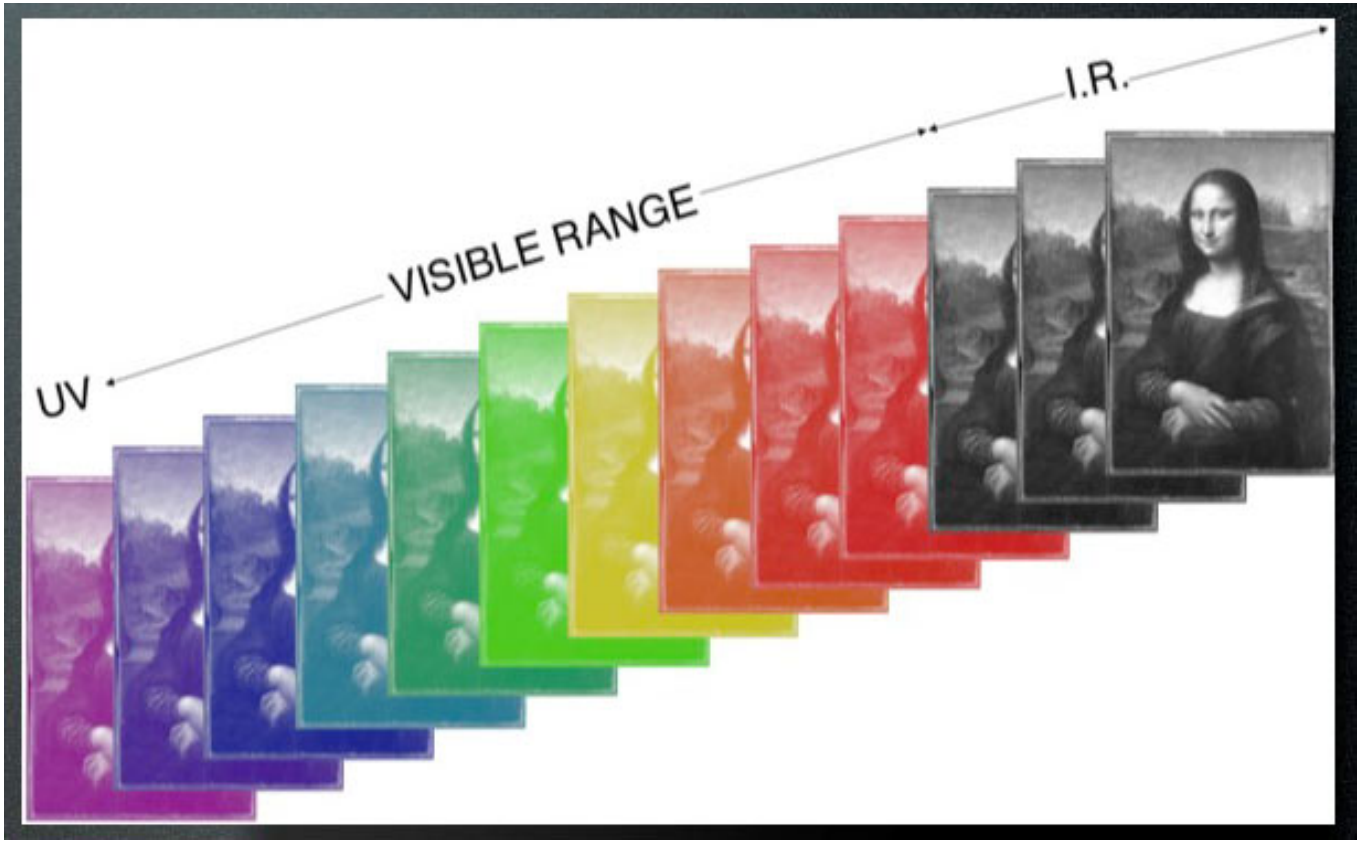

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Chromosome

- Chromosome: list of potential centroids **in multispectral space**
- Centroid is point from $[0, 255]^{bands}$
- We'll write `None` for non-existent centroids
- Sample chromosome:
  $[(100, 100, 100, 100), \mathit{None}, (5, 25, 125, 255), (123, 234, 134, 124), \mathit{None}]$

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Mutation

$$[(100, 100, 100, 100), \mathit{None}, (5, 25, 125, 255), (123, 234, 134, 124), \mathit{None}]$$

$$\downarrow$$

$$[(100, 100, 100, 100), (50, 75, 125, 200), (5, 25, 125, 255), (123, 234, 134, 124), \mathit{None}]$$

Crossover

$$[(100, 100, 100, 100), \mathit{None}, (5, 25, 125, 255), (123, 234, 134, 124), \mathit{None}]$$
$$[(34, 97, 160, 20), (199, 12, 64, 70), (63, 0, 49, 50), \mathit{None}, (1, 99, 18, 77)]$$

$$\downarrow k = 3$$

$$[(100, 100, 100, 100), \mathit{None}, (5, 25, 125, 255), \mathit{None}, (1, 99, 18, 77)]$$
$$[(34, 97, 160, 20), (199, 12, 64, 70), (63, 0, 49, 50), (123, 234, 134, 124), \mathit{None}]$$

Fitness function

- $KMI = 1/\left(\sum_{k=1}^{K}\sum_{i=1}^{N}\mu_{ik} \parallel x_i - \nu_k \parallel^2\right)$
- $XBI = N \cdot d_{min}^2 / KMI = N \cdot d_{min}^2 / \left(\sum_{k=1}^{K}\sum_{i=1}^{N}\mu_{ik} \parallel x_i - \nu_k \parallel^2\right)$
- $DBI = K / \sum_{k=1}^{K} \max_{j, j \neq k} \left\{\frac{S_k + S_j}{d_{kj}}\right\}$ where
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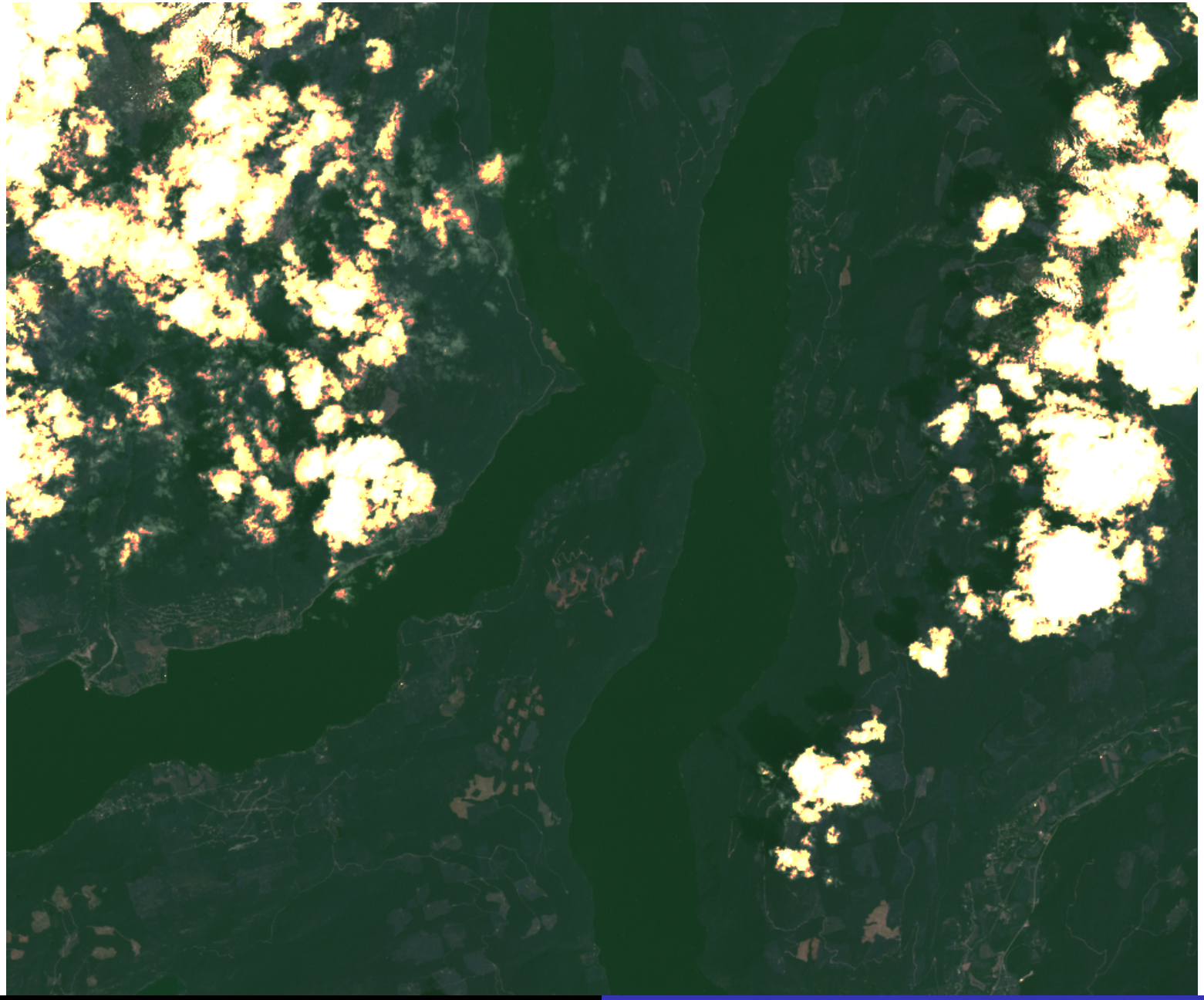
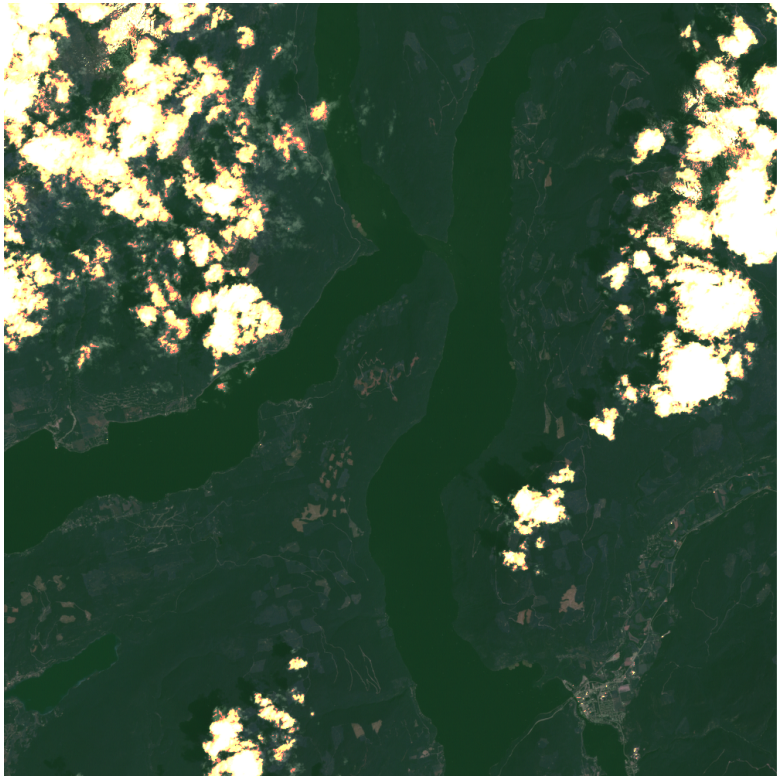
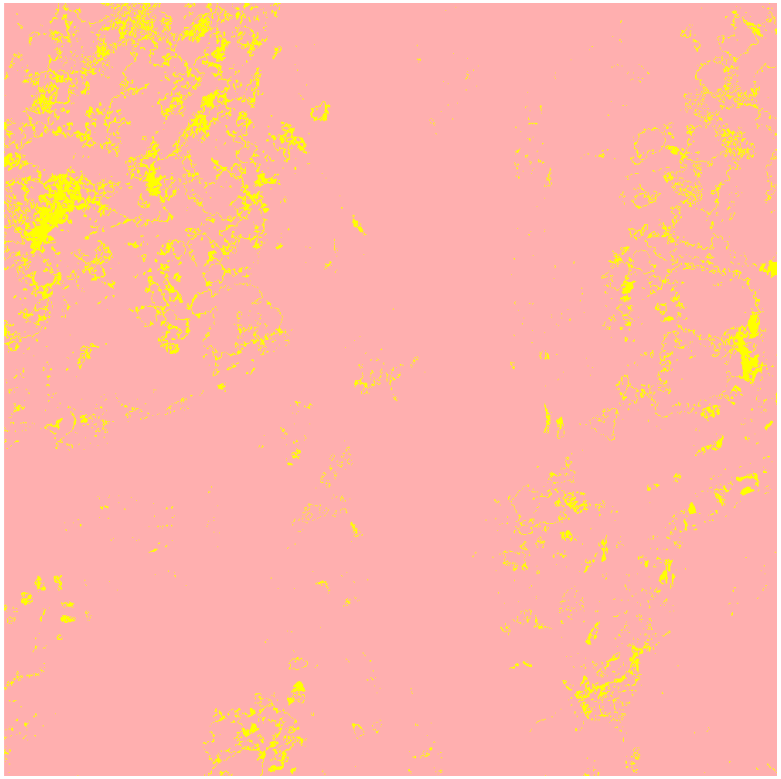
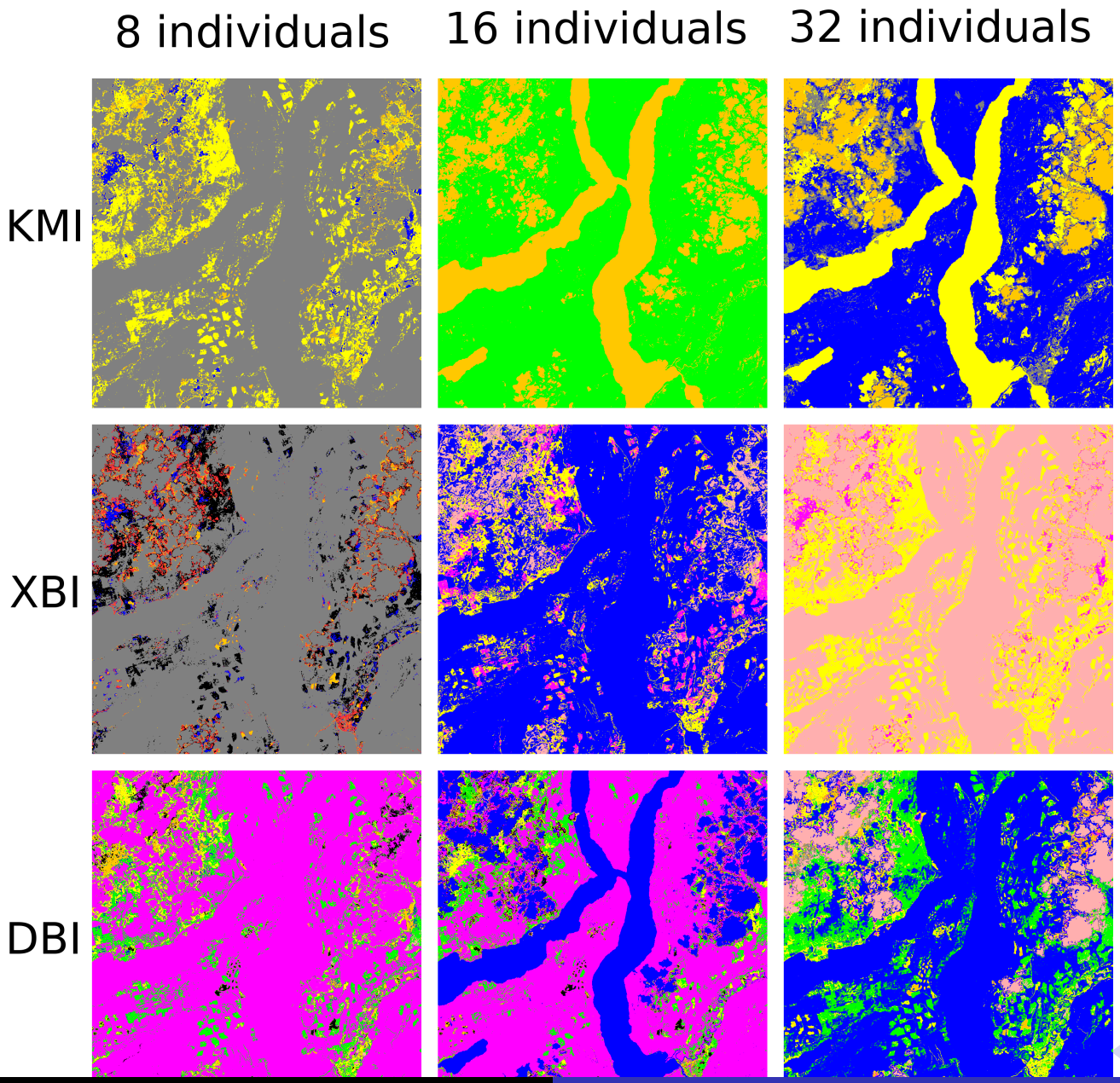
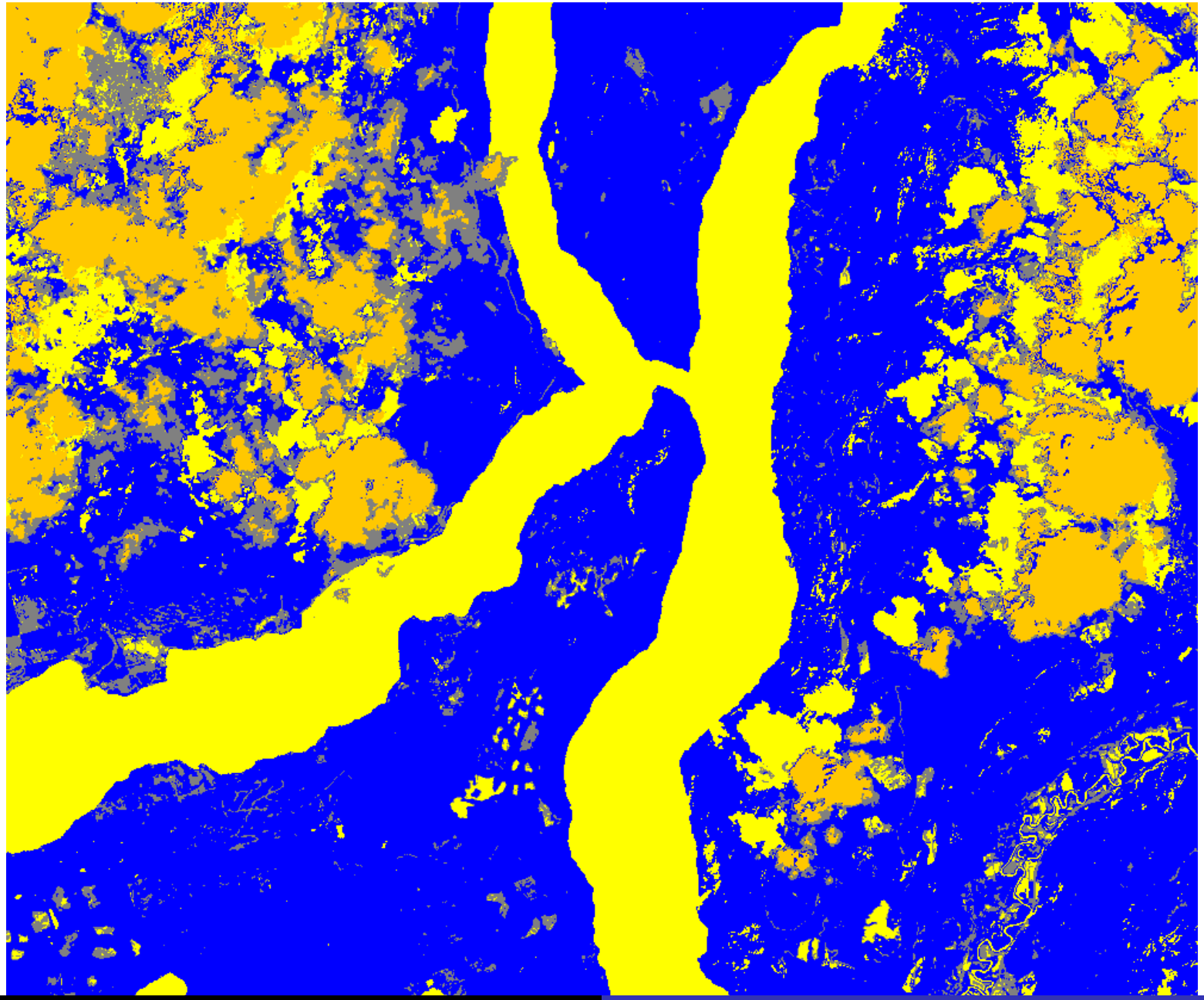







8 individuals
16 individuals
32 individuals
KMI
XBI
DBI



Index	16 individuals	32 individuals	64 individuals
KMI	40.4%	78.1%	86.3%
XBI	34.7%	38.0%	42.5%
DBI	36.2%	76.9%	49.1%

Table: Error values for different fitness functions