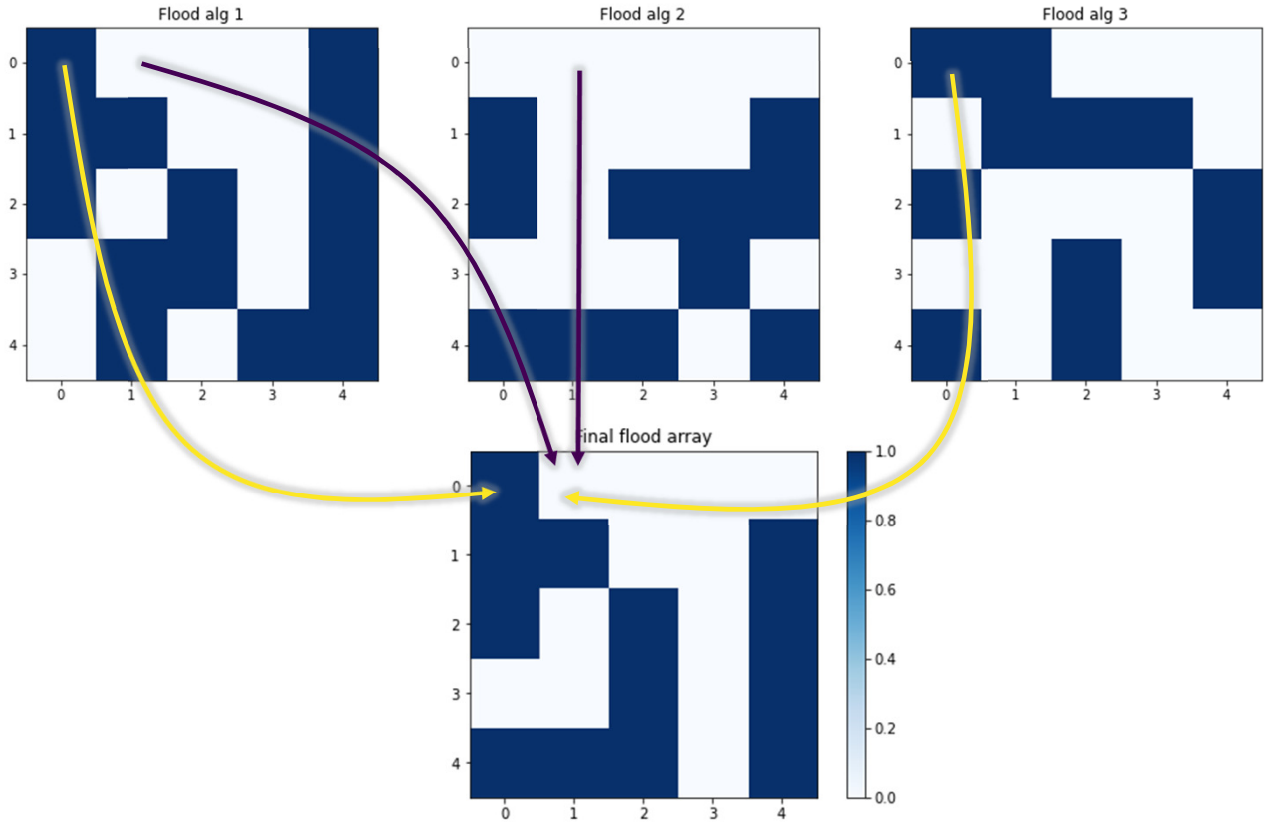
Ensemble Algorithm and Uncertainty

Framework Contract for Services 939866-IPR-2020

Overview

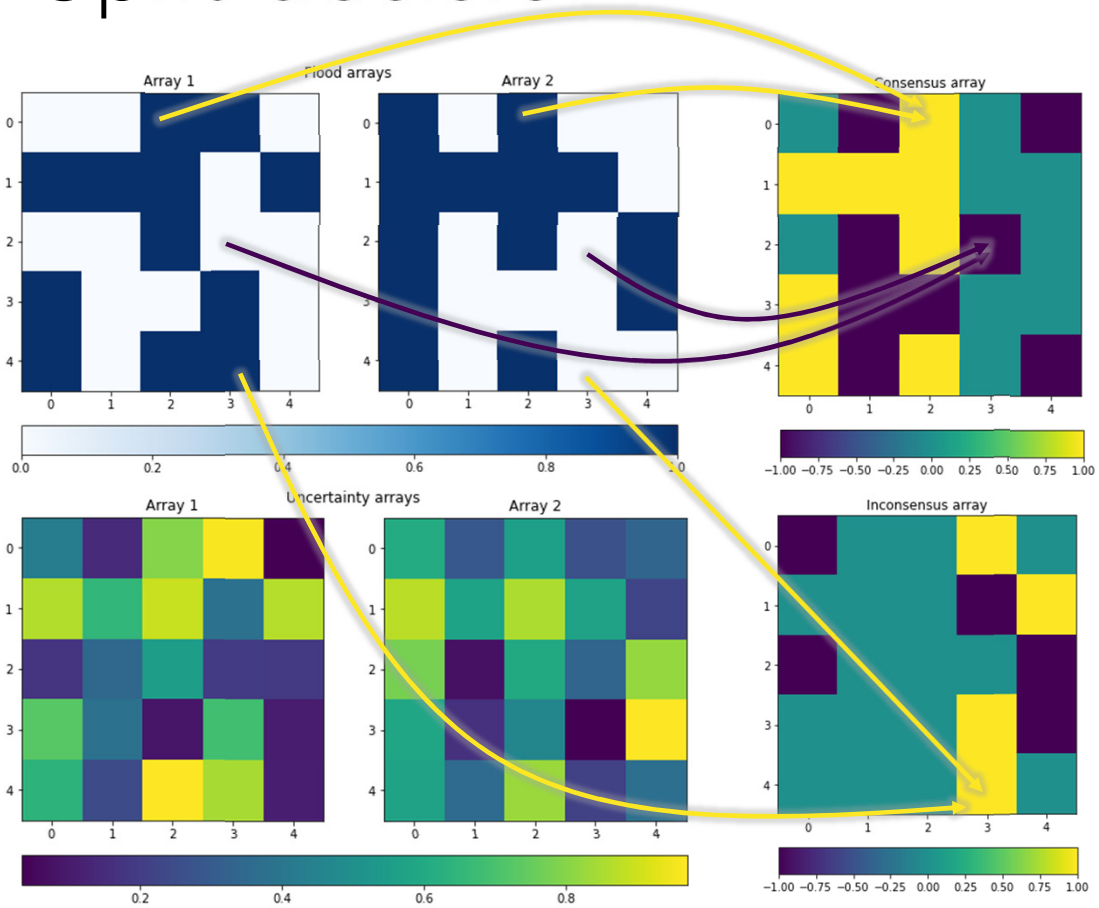
- Three algorithms produce flood maps along with uncertainty values
- Flood output as ensemble result from flood algorithms
- Usual case: Three flood results → **m**ajority vote
- Rare case: Two flood results → **s**plit decision
- Backup case: One flood result
- Output uncertainty as average input uncertainties

Majority vote



- Two out of three algorithms agree on a classification, either land or water

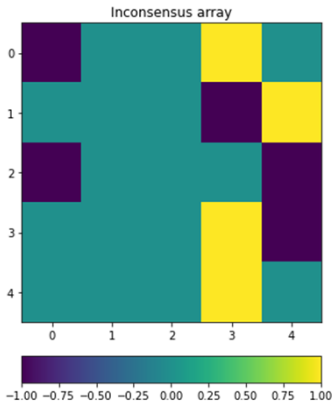
Split decision



- Yellow, where both algorithms agree on flood
- Purple, where both algorithms agree on land
- Petrol, where both algorithms disagree

- Yellow, where algorithm 1 detects water and algorithm 2 detects land
- Purple, where algorithm 2 detects water and algorithm 1 detects land
- Petrol, where both algorithms agree

Split decision: Uncertainties



Recap

- Yellow, where algorithm 1 detects water and algorithm 2 detects land
- Purple, where algorithm 2 detects water and algorithm 1 detects land
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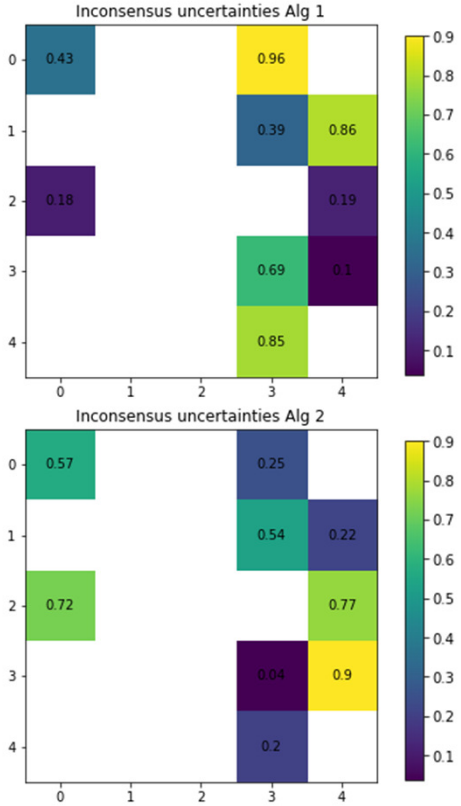
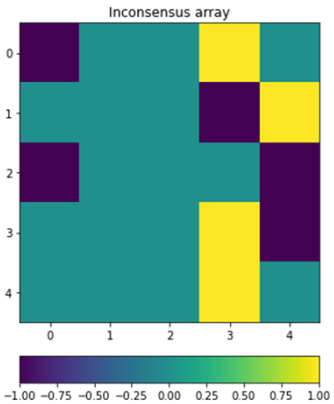


- Get uncertainty values at positions where both algorithms disagree

Split decision: Uncertainty analysis



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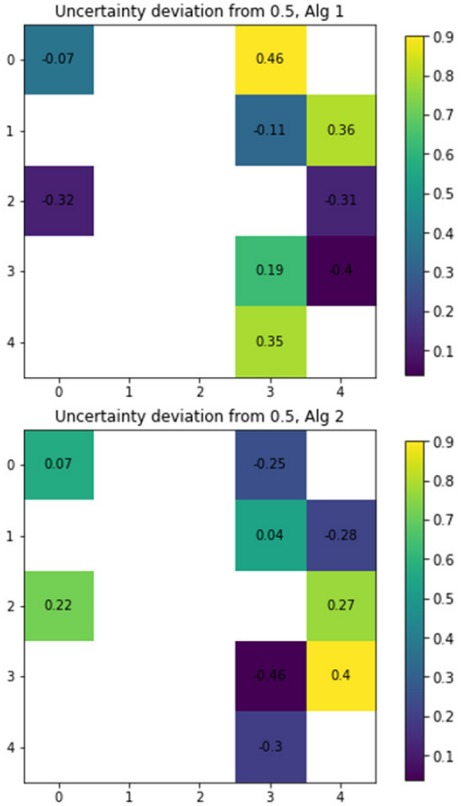
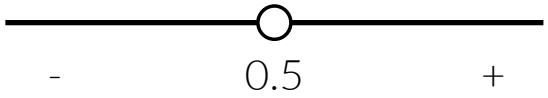
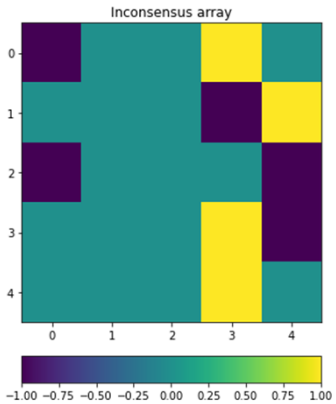


- Get deviations of uncertainties from 0.5
- The algorithm with the maximum deviation dictates the classification
  → high deviation indicates robust classification
- e.g., algorithm 1 deviates by -0.32 and algorithm 2 deviates by 0.22, the classification from algorithm 1 overrules the classification from algorithm 2
- Water detection is favoured over land in case of equal deviations
  → False alarms vs. missed alarms



Split decision: Results



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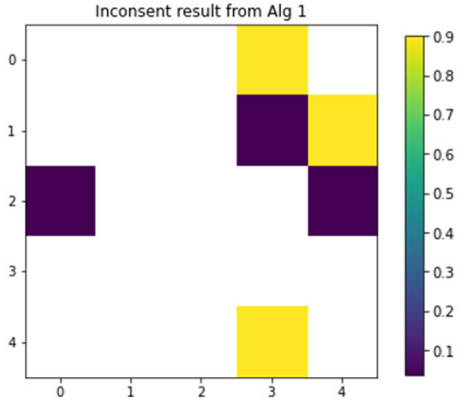

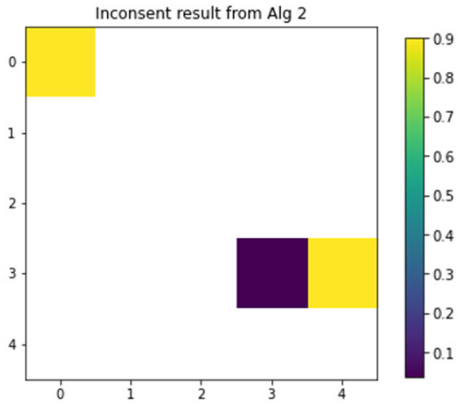

- Take classifications from single algorithm results
- Reminder: Water overrules land if uncertainty analysis produces equal results