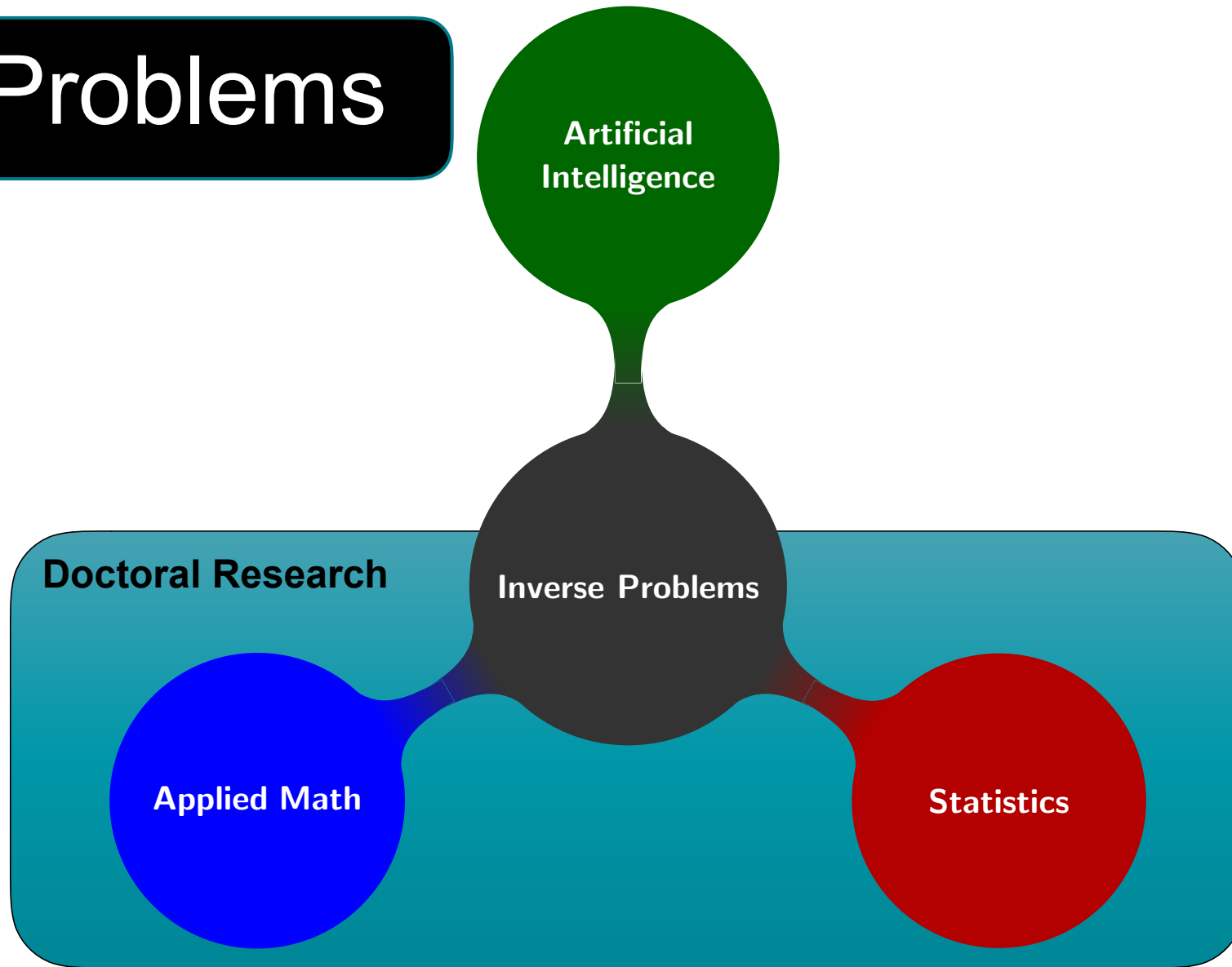


# Inverse Problems



## Inverse problem

$$y = \phi x + n \text{ where } \phi : x \mapsto y$$

Information lost

## ill posed

- Insufficient information to solve
- Degenerate solution space
- Unstable to inversion

## Applied Math

$$x^{\text{map}} = \underset{x}{\operatorname{argmin}} \left[ \underbrace{f(x)}_{\text{log-likelihood}} + \underbrace{g(x)}_{\text{log-prior}} \right]$$

*Data-fidelity*      *Regulariser*

### Advantages

- Low computational cost
- Highly scalable

### Disadvantages

- Approximate inferences
- Restricted to log-concave posterior functions

## Statistics

$$\underbrace{P(x|y, \phi, \mathcal{M})}_{\text{Posterior}} = \frac{\overbrace{P(y|x, \phi, \mathcal{M})}^{\text{Likelihood}} \overbrace{P(x)}^{\text{Prior}}}{\underbrace{P(y|\phi, \mathcal{M})}_{\text{Evidence}}}$$

### Advantages

- Asymptotically exact
- Any posterior

### Disadvantages

- Computationally expensive
- Large memory overhead
- Not scalable