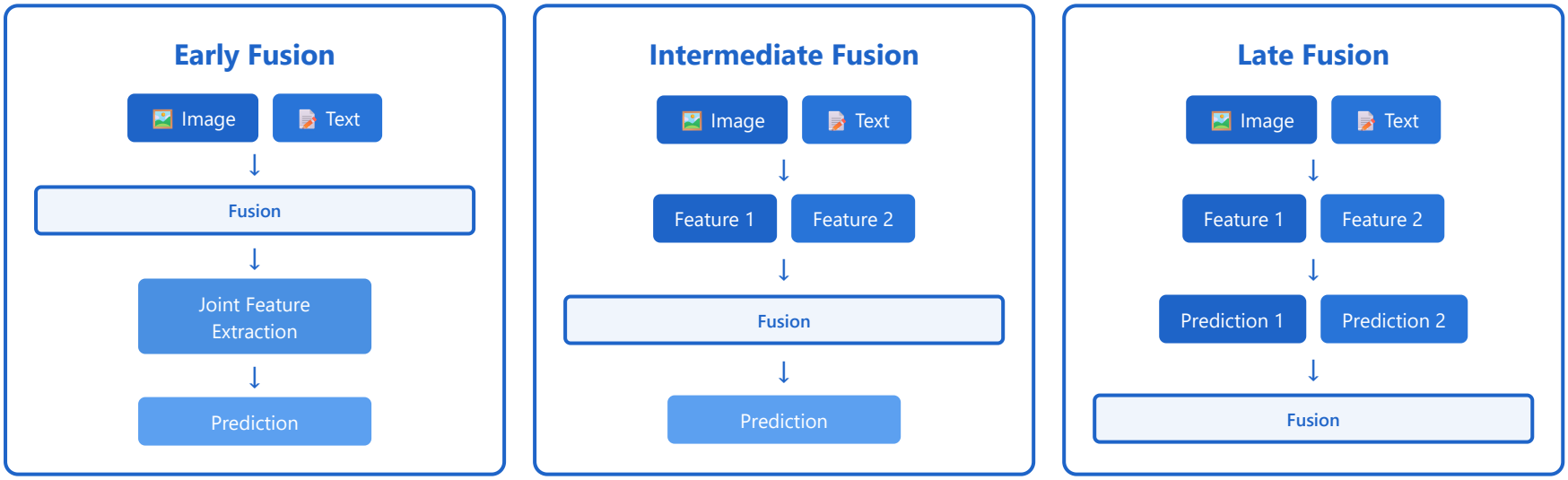
Early vs Late Fusion: Fusion Timing Strategies

Early Fusion: Combine before feature extraction / Late Fusion: Integrate after independent processing of each modality



Early Fusion

Input-level combination

- Combine raw data or early features
- Joint learning with single model

Pros: Strong integration

Cons: Curse of dimensionality

Intermediate Fusion

Mid-level combination

- Combine after partial processing of each modality
- Integration at intermediate representation level

Pros: Balanced approach

Cons: Design complexity

Late Fusion

Decision-level combination

- Complete independent processing of each modality
- Combine high-level predictions

Pros: Modality independence

Cons: Weak integration

Medical Application Examples

Early: CT + PET pixel-level fusion

Intermediate: X-ray + text feature combination

Late: Integration of imaging/genomic/clinical predictions

Selection Criteria

Early: Similar modality size/format, closely related

Late: Heterogeneous modalities, missing data possible

Hybrid: Complex multimodal systems