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Measuring the Accuracy of Predictions from Patient-Specific Models of Intracranial Pressure Dynamics

Wayne W. Wakeland
Portland State University, wakeland@pdx.edu

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Measuring the Accuracy of Predictions from Patient-Specific Models of Intracranial Pressure Dynamics

Wayne Wakeland
System Science Graduate Program, Portland State University, Portland, OR, USA

Objective

Determine the prediction capability of a computer model of ICP dynamics

Methods

- Clinically annotated prospective data collected: mild physiologic challenge protocol
  -- Head of bed: 0 to 30 degrees
  -- Respiration Rate: mild hyper- to hypo-ventilation
  -- 9 TBI patients, 24 sessions

- Data from early in single long session or from prior sessions used to estimate patient-specific parameter values for computer model of ICP dynamics
  -- Curve-fitting optimization minimized squared error, modeled ICP vs. data

- Resulting patient-specific models used to predict patient’s ICP response to interventions
  -- Later in the same session
  -- In subsequent sessions

Results

- Avg. mean absolute error (MAE) for fitness of model to the data: 1.9 mmHg
  → for segments with avg. mean absolute deviation of 3.1 mmHg

- Avg. MAE for predictions: 4.0 mmHg w/in same session;
  6.7 mmHg across sessions

Discussion/Conclusion

- Despite small error in model fit to data, model prediction error is too large to be clinically useful

- Caution warranted: prediction is hard!!
  → A good fit between model and historical data may not yield good predictions!

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