

## Course Form for PKU Summer School International 2026

<b>Course Title</b>	Title in English: Step-by-Step Guide to Predictive Modeling
	Title in Chinese: 手把手教你构建预测模型
<b>Teacher</b>	WANG Shengfeng, LIANG Baosheng, WANG Junfeng, LIU Molei, ZHENG Bang
<b>First day of classes</b>	July 6-July 17
<b>Last day of classes</b>	07-17
<b>Course Credit</b>	3 credits
<b>Course Description</b>	
<b>Objective:</b>	
<p>This course responds to the growing demand for AI-driven research and aims to teach students, step by step, how to build predictive models. It helps students conduct high-quality and meaningful predictive modeling studies, develop a genuine understanding of the purpose, concepts, workflow, and practical implementation of predictive modeling, and improve both their research capability and the quality of academic publications in prediction modeling. In addition, the course introduces the latest methodological developments and emerging trends in the field of predictive modeling.</p>	
<b>Pre-requisites /Target audience</b>	
<p>Students are required to bring their own computers. All students who wish to conduct predictive modeling research—namely those interested in using existing information to predict future outcomes—including, but not limited to, students from disciplines such as medicine, social sciences, education, management, economics, and related fields.</p>	
<b>Proceeding of the Course</b>	
<p>Lectures by the instructor (theory) + hands-on computer practice (practical training) + literature case discussions (application)</p>	
<b>Assignments (essay or other forms)</b>	
<p>Oral presentations</p>	
<b>Evaluation Details</b>	
<p>Students will work in groups. Each group will either introduce the latest developments in predictive modeling methods or develop a complete predictive modeling proposal.</p> <p>Presentation Requirements: Slides presentation + 15 minutes presentation per group + Q&amp;A and discussion: 5 minutes</p>	
<b>Text Books and Reading Materials</b>	
<p>Clinical prediction models: A practical approach to development validation, and updating (2<sup>nd</sup>)</p> <p>Clinical prediction models: methodology and application (In Chinese).</p>	
<b>Academic Integrity (If necessary)</b>	

<b>CLASS SCHEDULE</b> (Subject to adjustment)	
Session 1: <i>Fundamentals of Predictive Modeling</i>	Date: 07-06
<b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b> <ul style="list-style-type: none"> <li>Basic concepts of predictive models</li> <li>Workflow of predictive model development (topic selection, defining prediction outcomes and predictors, sample size calculation)</li> <li>Data acquisition for predictive modeling (study design)</li> </ul> <b>Hands-on Practice:</b> <ul style="list-style-type: none"> <li>Introduction to R package operations</li> </ul>	
<b>【Questions】</b> Which is the most basic step for predictive model development?	
<b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2 <sup>nd</sup> ) Clinical prediction models: methodology and application (In Chinese).	
<b>【Assignments for this session (if any)】</b>	
Session 2: <i>How to Read Predictive Modeling Papers</i>	Date: 07-07
<b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b> <ul style="list-style-type: none"> <li>Reporting standards for predictive models</li> <li>Quality assessment of predictive models</li> <li>Interpretation and discussion of classic predictive modeling papers (using TRIPOD+AI to identify key reporting elements)</li> </ul>	
<b>【Questions】</b> How to Evaluate the Quality of a Predictive Modeling Study	
<b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2 <sup>nd</sup> ) Clinical prediction models: methodology and application (In Chinese).	
<b>【Assignments for this session (if any)】</b>	
Session 3: <i>Development of Predictive Models</i>	Date: 07-08
<b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b> <ul style="list-style-type: none"> <li>Model selection in predictive modeling</li> <li>Predictor selection</li> </ul>	

<ul style="list-style-type: none"> <li>• Variable screening and model inclusion strategies</li> <li>• Model presentation (interpretability, nomograms)</li> </ul> <p><b>Hands-on Practice:</b></p> <ul style="list-style-type: none"> <li>• Sample size calculation</li> <li>• Predictor transformation and computation of model performance metrics</li> </ul>	
<p><b>【Questions】</b> How to Determine Sample Size for Prediction Model Studies</p>	
<p><b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).</p>	
<p><b>【Assignments for this session (if any)】</b></p>	
Session 4: <i>Validation of Predictive Models</i>	Date:07-09
<p><b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b></p> <ul style="list-style-type: none"> <li>• Model performance evaluation framework</li> <li>• Internal validation</li> <li>• Internal–external validation</li> <li>• External validation</li> </ul> <p><b>Hands-on Practice:</b></p> <ul style="list-style-type: none"> <li>• Predictive model validation</li> </ul>	
<p><b>【Questions】</b> How to Validate the Performance of a Prediction Model</p>	
<p><b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).</p>	
<p><b>【Assignments for this session (if any)】</b></p>	
Session 5: <i>Evaluation of Predictive Model Applications</i>	Date:07-10
<p><b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b></p> <ul style="list-style-type: none"> <li>• Evaluation based on model performance metrics</li> <li>• Evaluation based on decision analysis models</li> <li>• Evaluation based on clinical trials</li> <li>• Evaluation based on real-world data</li> </ul>	
<p><b>【Questions】</b> How to Evaluate the Impact of Model Application</p>	
<p><b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).</p>	
<p><b>【Assignments for this session (if any)】</b></p>	

Session 6: <i>Development and Validation of Diagnostic Prediction Models</i>	Date:07-13
<b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b> <ul style="list-style-type: none"> <li>• Development of diagnostic models</li> <li>• Validation of diagnostic models</li> <li>• Modeling using nested case-control data</li> </ul> <b>Hands-on Practice:</b> <ul style="list-style-type: none"> <li>• Case reproduction and practical implementation of diagnostic prediction models</li> </ul>	
<b>【Questions】</b> How to Develop a Diagnostic Prediction Model	
<b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).	
<b>【Assignments for this session (if any)】</b>	
Session 7: <i>Development and Validation of Prognostic Prediction Models</i>	Date:07-14
<b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b> <ul style="list-style-type: none"> <li>• Development of prognostic models</li> <li>• Validation of prognostic models</li> <li>• Model development and validation using nested case-control studies</li> <li>• Model development and validation using cohort data</li> </ul> <b>Hands-on Practice:</b> <ul style="list-style-type: none"> <li>• Case reproduction and practical implementation of prognostic prediction models</li> </ul>	
<b>【Questions】</b> How to Develop a prognostic Prediction Model	
<b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).	
<b>【Assignments for this session (if any)】</b>	
Session 8: <i>Advanced Topics</i>	Date:07-15
<b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> <b>Core Content:</b> <ul style="list-style-type: none"> <li>• Handling missing data</li> </ul>	

<ul style="list-style-type: none"> <li>• Model updating</li> <li>• Population-specific modeling (improving model transportability)</li> <li>• Considerations of model fairness</li> </ul>	
<p><b>【Questions】</b> How to Update a Prediction Model</p>	
<p><b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).</p>	
<p><b>【Assignments for this session (if any)】</b></p>	
<p>Session 9: <i>Systematic Review and Meta-analysis of Prediction Models</i></p>	<p>Date:07-16</p>
<p><b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b> Core Content:</p> <ul style="list-style-type: none"> <li>• Formulating research questions</li> <li>• Developing search strategies</li> <li>• Literature screening and risk-of-bias assessment (PROBAST+AI)</li> <li>• Data extraction</li> <li>• Meta-analysis methods</li> <li>• Results synthesis and reporting</li> </ul>	
<p><b>【Questions】</b> How to Conduct a Meta-analysis of Prediction Models</p>	
<p><b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).</p>	
<p><b>【Assignments for this session (if any)】</b></p>	
<p>Session 10: <i>Final Presentations and discussion</i></p>	<p>Date:07-17</p>
<p><b>【Description of the Session】 (purpose, requirements, class and presentations scheduling, etc.)</b></p> <ul style="list-style-type: none"> <li>• For methodological progress presentations, the content should include at least: existing problems, principles and implementation of new methods, application cases, and personal insights. The discussion should not be limited to a single publication; students are encouraged to develop a comprehensive understanding.</li> <li>• For modeling proposals, the content should include at least: research background, objectives, research content, methodology, innovation, as well as strengths and limitations.</li> </ul>	
<p><b>【Questions】</b> No pre-specified questions</p>	
<p><b>【Readings, Websites or Video Clips】</b> Clinical prediction models: A practical approach to development validation, and updating (2nd) Clinical prediction models:methodology and application (In Chinese).</p>	
<p><b>【Assignments for this session (if any)】</b></p>	