Workshop Report: "An Introduction to Machine Learning for Language Assessment"

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Introduction

On July 17 and 18 (2024), Dr Vahid Aryadoust conducted a two-day online workshop titled *"An Introduction to Machine Learning for Language Assessment"*. The workshop was designed to help language educators, researchers, and assessment professionals explore how machine learning—an advanced branch of artificial intelligence—can transform the field of language assessment.

Machine learning, at its core, refers to the ability of computers to learn from data and make predictions or decisions without being explicitly programmed. Unlike traditional statistical methods that often rely on fixed assumptions and linear relationships, machine learning can identify complex patterns and relationships in data, even when those patterns are not immediately apparent to humans. This makes machine learning particularly valuable for tasks like analyzing large sets of language data, detecting subtle trends, and predicting outcomes with high accuracy. For example, it can help assess student performance, detect plagiarism, or evaluate language proficiency by analyzing nuanced linguistic features.

As the world becomes increasingly digital, the integration of machine learning into language assessment is no longer optional but essential. It offers tools to tackle emerging challenges and opportunities in education, such as predicting test performance of test takers and identifying predicting variables for test-specific processes and behaviors. This workshop aligned closely with UKALTA's mission to promote professional development and innovation by equipping attendees with the skills to harness these cutting-edge technologies.

The sessions were conducted via Zoom and recorded for wider access through the *Statistics and Theory* YouTube Channel, further ensuring the content reaches a broad audience.

Workshop Content and Activities

The workshop was divided into two sessions, each lasting two hours. It combined theoretical explanations, practical examples, and hands-on exercises. Key topics covered included:

1. **Fundamental Concepts of Statistical and Machine Learning**:
    - The distinction between statistical inference (conventional methods) and prediction (machine learning approaches).

    - Introduction to the General Linear Model (GLM) as a flexible framework that encompasses methods such as linear regression, ANOVA, and t-tests.

2. **The Machine Learning Roadmap**:
    - A progressive transition from statistical linear regression to neural networks and advanced machine learning algorithms.
    - Discussions on the principles of supervised and unsupervised learning, including regression, classification, and clustering techniques.
3. **Assumptions of Regression Analysis**:
    - Detailed exploration of key assumptions such as linearity, independence, homoscedasticity, normality, and multicollinearity.
4. **Artificial Neural Networks (ANNs)**:
    - A historical overview of ANN development, highlighting significant milestones and their implications for modern machine learning.
    - Explanation of neural network components, such as hidden layers, activation functions, and optimization techniques.
5. **Activation Functions and Algorithms**:
    - Discussion of activation functions (e.g., sigmoid, ReLU, tanh) and their roles in neural network learning processes.
    - Introduction to backpropagation and its enhanced variants (e.g., resilient propagation methods) for training neural networks.
6. **Network Topology and Design**:
    - Guidelines for structuring neural networks, including setting hidden layers and determining the number of nodes per layer.
    - Practical heuristics to optimize network performance while ensuring simplicity.

Hands-On Components

Participants were engaged in practical exercises using the JASP software, a user-friendly platform for statistical analysis and machine learning. These activities allowed attendees to:

- Build and interpret basic machine learning models.
- Apply neural network principles to real-world language assessment data.
- Experiment with network topology settings to optimize performance.

Participant Engagement

The workshop attracted a diverse group of language educators, assessment professionals, graduate students, and researchers. Overall, 173 people from 27 countries registered in the workshops, with 84 people attending. Attendees actively participated in discussions, raised insightful questions, and provided positive feedback regarding the clarity and relevance of the content.

Video-recorded Workshops on the Statistics and Theory Channel

The two workshop videos have been made publicly accessible on Vahid Aryadoust's *YouTube* channel, *Statistics and Theory*. The links are provided below:

Day 1: Machine Learning Workshop Part 1 | Linear Regression with JASP **https://youtu.be/LL0JF8PUP6A**

Day 2: Machine Learning Workshop Part 2 | Neural Networks & Regression
https://youtu.be/P6j_AL2YWuk

Relevance to UKALTA's Objectives

This workshop contributes to UKALTA's mission by:

- Enhancing participants' understanding of advanced assessment technologies.
- Promoting professional development through accessible, cutting-edge training.
- Encouraging collaboration and knowledge exchange in the field of language assessment.
- Demonstrating the practical applications of AI in tackling challenges in language data analysis.

Logistics

The workshops were conducted on the Zoom platform, with registration and administrative support provided by Lynette Wee from the English Language and Literature Department at the National Institute of Education, Nanyang Technological University, Singapore.

Conclusion

The workshop was a success. I hope that it has equipped participants with foundational knowledge and practical skills in machine learning for language assessment. The recorded sessions, hosted on the *Statistics and Theory* YouTube Channel, will ensure that the content reaches a wider audience, amplifying its impact. In my view, this initiative underscores UKALTA's dedication to fostering innovation and technological advancement in language assessment practices.