

Reform and Practice Analysis of Voice Signal Processing Experiments

Qiong Hu, Qi Li

Nanjing Tech University Pujiang Institute, Nanjing, Jiangsu Province, 210000

Abstract: The course on “Speech Signal Processing” encompasses various professional topics, such as time-domain signals and transformations, with a rapid pace of updates. Therefore, during the exploration and analysis of closely related experiments, one should prioritize the development trends of speech application technologies. It is essential to continuously reform experimental teaching methods and base these on practical teaching content. Ongoing updates are necessary for course experiment content and methods, curriculum design schemes, and other related areas. This approach yields optimal outcomes for teaching reforms and practical applications. Consequently, this paper embarks on a series of analyses and discussions centered on this topic, offering numerous recommendations for industry stakeholders.

Keywords: Speech signals; Processing experiments; Reform practices

Introduction

The rapid rise of artificial intelligence has made voice vital for human-computer interaction. Many universities now offer voice signal processing courses to equip future professionals. This field, pivotal in information processing, requires substantial theoretical knowledge. It combines theoretical concepts with practical applications. Teaching must incorporate multimedia presentations and hands-on experiments. Emphasizing experimental design optimization alongside theory is crucial. Continuous innovation and reform are essential in this context.^{[3][4]}

1. The Important Significance and Challenges of Reforming and Practicing Voice Signal Processing Experiments

Reforming speech signal processing experiments is vital across multiple dimensions. Specifically, it can improve experiment quality and efficiency. Students gain valuable insights, enhancing their integration of theory and practice. This reform can also spark interest in related fields, boosting overall learning capabilities. Moreover, advancements in these experiments deepen students’ theoretical understanding, fostering their grasp of fundamental concepts, which promotes sustainable development in teaching. However, challenges persist in implementing these reforms.^[6]

Speech signal processing covers diverse applications such as recognition, identification, enhancement, and synthesis. This course will explore theories like vector quantization and hidden Markov models, but content complexity may increase experimental factors. Balancing limited class hours with hands-on engineering education remains a crucial issue.^[7] Improving course quality while developing students’ practical skills within time constraints is a significant concern.

2. Issues to Consider in the Reform and Practice of Voice Signal Processing Experiments

In the process of reform and practice in speech signal processing experiments, many issues require significant attention. Specifically, these problems mainly include the following aspects:

2.1 The Rational Formulation of Reform and Practice Plans

Rational planning is vital in speech signal processing experiments. Scientifically sound plans provide a solid foundation for advancements. Additionally, well-structured practice plans boost efficiency, aiding future progress.

2.2 The Organic Integration of Theory and Practice

To achieve effective reform in speech signal processing, it's crucial to integrate theory with practice.^[8] Implement practical measures based on real conditions, and refine theoretical applications through practical results. Continuous improvement is necessary to achieve successful outcomes in speech signal processing experiments.

2.3 Establishment of a targeted evaluation mechanism

Establishing a targeted evaluation mechanism is vital for reforming speech signal processing experiments. A scientific evaluation assesses the effectiveness, provides insights, and enables corrections of any shortcomings in the process.

2.4 The Critical Role of Talent

Talent plays a key role in reforming and implementing experimental teaching in speech signal processing. Valuing talent enhances reform effectiveness and helps accumulate experience.^[9] The professional skills and qualities of talent directly impact the outcomes, making it essential to recognize their importance.^[10]

3. Reform and Practical Targeted Strategies for Speech Signal Processing Experiments

3.1 Develop experimental teaching materials grounded in scientific principles, clearly defining training objectives

In the reform of voice signal processing experiments, it is crucial to develop scientific materials and clarify training objectives. Well-crafted materials ensure smooth teaching, enhance students' understanding of theory, and maintain engagement. Prioritizing operability and continuity increases interest and educational outcomes. Clear training objectives enable tailored content to meet students' needs, improving professional skills. Targeted experimental setups for research-oriented and engineering application-oriented students can significantly boost reform effectiveness.^[11]

3.2 Establish a comprehensive and optimized experimental teaching system

Classroom experiments are vital for reinforcing theoretical foundations in speech signal processing, an interdisciplinary field requiring strong skills in speech signal analysis.^[12] To optimize experimental teaching, it's crucial to integrate theory and practice, ensuring students can apply relevant theories to practical problems. Key focuses include:

- Clarifying content and techniques: Build on core speech signal theories and programming, with experiments in areas like time-domain feature analysis, LPC analysis, and spectral subtraction. Tailor content to educational goals and student levels.
- Choosing the right environment: MATLAB is ideal for simulations, enhancing student engagement and helping them focus on theory. Its visualization tools improve understanding and efficiency.^[13]
- Curriculum design: Organize group experiments to guide students effectively and prevent aimlessness during practical sessions.

3.3 Continuously adopt international best practices to foster innovation in speech signal processing experiments

In reforming speech signal processing experiments, it is crucial to continuously incorporate advanced past experiences to foster innovation. For instance, MIT regularly conducts experiments on phonetic analysis, vowel-consonant discrimination, and speech synthesis, combining experimental and project reports to produce scientific outcomes, setting a foundation for experimental development. At Cambridge University, students undertake structured project experiments leading to thesis-driven conclusions. Additionally, University of Science and Technology Beijing has innovated by focusing on fundamental knowledge, speech signal analysis, algorithms, and applications, emphasizing autonomy and depth. These approaches offer valuable insights for reforming speech signal processing experiments in our country.

3.4 Recognize the vital role of various types of projects in speech signal processing

In the reform of speech signal processing experiments, foundational and independent projects play key roles. Foundational projects, such as feature analysis and speech recognition, form the basis for all experimental operations. Independent projects, developed after mastering fundamentals, enhance innovation by allowing students to tackle advanced topics and analyze experimental content. This approach deepens their understanding of speech signal processing applications.^[15]

3.5 Establish a scientific evaluation system to continuously improve the professional level of the talent pool

In reforming voice signal processing experiments, establishing a scientific evaluation system is vital for enhancing professional competence. This system helps assess the impact of reforms, enabling timely corrections to improve focus and outcomes. Additionally,

enhancing the skills of personnel is crucial. Key steps include improving talent selection criteria, conducting regular specialized training to boost professional capabilities, and creating a performance appraisal system linked to contributions to the reforms, increasing motivation and fostering a high-quality talent pool.

Conclusion

In summary, speech signal processing courses are highly theoretical, but theoretical instruction alone does not equip students to apply their knowledge effectively. Therefore, emphasizing experimental teaching is essential. Current experimental teaching in this field faces challenges that hinder course development. This paper proposes reform strategies focused on experimental teaching and practice. Key strategies include developing scientific teaching materials, clarifying training objectives, establishing a comprehensive experimental system, optimizing setups, learning from international practices, fostering innovation, highlighting the role of projects, and creating a scientific evaluation system to improve professional competence.

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About the author:

Qiong Hu, Female, Date of Birth: June 1990, Ethnicity: Han, Place of Birth: Jiangsu, Education: Graduate, Title: Lecturer, Research Field: Digital Signal Processing.