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PS-1: ICICIC2021-SS01-08

Kalman Filtering with Finite-Step Autocorrelated Measurement Noise

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Abstract. This paper is concerned with the Kalman filtering problem for discrete-time linear systems corrupted by finite-step autocorrelated measurement noise which is a linear function of several mutually uncorrelated random vectors. An optimal Kalman filter is presented using state augment approach. Then, by new techniques developed in this paper, the convergence conditions of the optimal Kalman filter are established by equivalently considering the convergence of the prediction state error covariance of an augmented system where, different from the existing results, the matrix difference equation of the prediction augmented-state error covariance (PASEC) has a unique structure, that is, the matrix difference equation of the PASEC does not contain the measurement noise covariance and the process noise covariance of the augmented system in the equation is not positive definite. The main novelty of this paper is the theoretical analysis of the asymptotic convergence behavior of the PASEC whose matrix difference equation has the unique structure mentioned above. An example is presented to illustrate the effectiveness and advantages of the proposed new design strategy.

Keywords: Kalman filtering, Discrete-time, Linear systems, Finite-step autocorrelated, Convergence

PS-2: ICICIC2021-SS01-14

Multi-UAV Cooperative Ground Target Tracking Based on an Improved Artificial Potential Field Method

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Abstract. In this paper, we investigate the multi Unmanned Aerial Vehicle (UAV) cooperative ground target tracking based on vision and communication information. Firstly, the UAV platform is established as the basis for the verification of target tracking tasks. Each UAV has a camera to observe the target and a processor to implement a deep learning algorithm to recognize and estimate the target position. In addition, the multi-UAV formation control method based on the combination of Artificial Potential Field (APF) and virtual navigator is proposed. This method avoids collisions with obstacles and neighbors while obtaining a larger observation range. Finally, the real flight experiment results show that the target tracking algorithm realizes a reasonable position estimation and the formation control algorithm achieves continuous tracking of the target by the UAV formation.

Keywords: Multi UAV, APF, Coordinated tracking, Target localization
Detecting the Factors Affecting Learning Performance of Students with Different Learning Styles in Flipped Learning

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Abstract. The study employed a rigorous procedure to validate the proposed factors of student with different learning styles affecting learning performance in flipped learning. The participants of the study were pre-service teachers in China, with a total of 42 students majoring in science. Two pre-validated scales including the scale of online self-regulation and the scale of peer assessment, were completed and the reliabilities were calculated. The Felder-Soloman Index of Learning Style Questionnaire was used to identify students’ learning styles. The data were analyzed using exploratory factor analysis, correlation analysis and t test. The results reveal that the flipped learning significantly promoted the students’ learning performance. Students’ attitudes toward online self-regulation and peer assessment significantly affected students’ learning performance. Students with different learning styles had the different needs of their online self-regulation and peer assessment. The findings can provide good references for improvement of the flipped learning.

Keywords: Flipped learning, Learning style, Online self-regulation, Peer assessment, Student engagement

An Analysis of the New Curriculum of Taiwan’s High Schools Integrated with International Education Curriculum

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Abstract. The new syllabus for high schools in Taiwan was formally implemented in 2019. The concept and goal of the new syllabus is “core competence” as the main axis of the new syllabus. The integration of themes into various fields is an important feature of the new syllabus. The leading high school was assigned to propose a review of curriculum planning and implementation problems and suggestions for solving strategies for the trial implementation of the new curriculum syllabus. This research is aimed at the planning of the integration of international education in 13 leading high schools in Taiwan, using bootstrapping research methods to analyze the five types of courses in the new syllabus planning, and find out whether the international education curriculum of Taiwan’s high schools meets the core competence-oriented planning of the new syllabus. The results of the research show that the international education curriculum planning in the new curriculum syllabus of the leading high school is more consistent with the connotation of the international literacy orientation in the “White Paper on International Education for Primary and Secondary Schools”: Electives General Courses-Multiple Electives (History, Culture and Economy). In addition to deepening the learner’s understanding of foreign cultures, it is also in line with the goal of cultivating international literacy “multiculturalism and international understanding”; the curriculum is also
diversified, especially alternative learning sessions are favored by schools. The above two courses are more able to show the characteristics of the new syllabus. Electives General Courses-Multiple electives (Language), like School-developed requires General Courses, cannot highlight the characteristics of the new syllabus of international education, and can be regarded as laying the foundation for foreign language learning.  

**Keywords:** New curriculum, High schools, International education, Core competency

**PS-5: ICICIC2021-SS12-20**

Estimation of Construction Cost of Smart Joint Refrigerated Logistics Center Applying Collaborative Game Theory –A Case Study of Republic of Korea–

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**Abstract.** In Korea, the smart logistics center is jointly developed to meet the exact material delivery schedule for the smart manufacturing process. The reason is that the utilization rate of the smart manufacturing process can be increased by decreasing the material delivery schedule through the smartization of the common logistics center. However, because the cost of constructing a smart joint logistics center is very high, efforts to reduce the construction cost are required. In this study, we developed a construction cost estimation model for logistics companies involved in constructing a smart joint logistics center, to which a collaborative game theory is applied. In addition, Korea's smart joint logistics center was divided into four scales based on the construction cost calculation model, and the construction cost of the smart joint logistics center was determined for each scale capable of supporting smart manufacturing processes. Therefore, the application of the proposed methodology will help expand the construction of the smart joint logistics center and continuously operate the smart manufacturing process.  

**Keywords:** Smart joint logistics center, Collaborative game theory, Construction cost, Case study

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**PS-6: ICICIC2021-033**

A Mixture-Model-Based Framework for Fraud Detection

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**Abstract.** The major challenges to be addressed in fraud detection applications contain imbalanced data processing and classification algorithm. Class distribution is usually unbalanced since legitimate transactions far outnumber fraudulent ones. The fraud detection system (FDS) needs to
handle this problem in both preprocessing and classification phases. This paper presents a new framework for FDS based on the concept of the mixture model to handle imbalanced data processing and classification algorithm. In this paper, the Gaussian mixture model (GMM) is used for modeling original data whether it is fraudulent (minority) or legitimate (majority) data, and then generate data for over-sampling or under-sampling. Meanwhile, the GMM is also applied to being a classification model for determining fraudulent and legitimate transactions. In the experiments, we implement the GMM framework on the BankSim database for the fraud detection task. The results validate the effectiveness of the proposed approach both in preprocessing and classification phases.

**Keywords:** Gaussian mixture model, Imbalanced data processing, Fraud detection

**PS-7: ICICIC2021-047**

**Production Planning for LED Wafer Fabrication and Chip Packaging with Lagrangian Relaxation Heuristics**

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**Abstract.** In this paper, we propose Lagrangian relaxation heuristics to obtain near optimal production plan for LED wafer fabrication and chip packaging. In the front-end process of the LED manufacturing, wafers are fabricated with circuit patterning. In this process, product type of wafers is determined by their die sizes, and wave length of emitting light. In the backend process, the wave length can be adjusted by applying a fluorescent substance on the surface of LED dies. The product types are binned according to the wave length, and this binning is not stabilized and overlapped with different product types of wafer fabrication. Therefore, the production plan, determining release quantity of wafers and chips to production, should be recalculated quickly enough in the case that the binning ratio becomes greatly disturbed to meet the customers’ demand. Results of computational tests showed that the near optimal production plan can be obtained within a half hour, while the optimal solution can be obtained around 2 hours CPU time with a commercial solver. The percentage gap between optimal and Lagrangian heuristics is less than 5% for the single period problem.

**Keywords:** Production planning, Lagrangian relaxation heuristics, LED, Mixed integer programming, Wafer fabrication, Chip packaging