

Emerging Industry for Promoting Human Performance and Health: Opportunities and Challenges

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1. Introduction

In the 21st century, with a highly developed economy and a diverse cultural society, it is not uncommon to see people suffer spiritual stress and physical pain in their lives. It is an interwound negative cycle where the more pressure or pain people feel, the greater the influence on their human performance and health, which again results in more stress and more physical pain. The high pressure entailed by overwhelming business competitions and the rapid-changing situations of global trading have a long-lasting impact on human performance and health. Clinical medical treatment usually eradicates the symptoms in the short term but shows no significant improvement in patients' life quality in the long term because the essential working environment and social interactions do not change. Moreover, the advent of the COVID-19 pandemic posed a tremendous setback to the economy and decreased support from social interactions. The global supply chains were significantly delayed or cutoff due to the quarantine practice at state borders. People having cold symptoms are anxious about the on-site clinical check because they are worried about getting infected by COVID-19-positive patients. People suffer these mental and physical burdens at work and at home.

When everything seems hopeless, it also opens up new opportunities for emerging industries. We observe at least three opportunities proposed by the collected articles in this Special Issue. Firstly, in addition to the clinical medical treatment of diseases, untraditional treatments or assisted interventions have played a vital role in promoting human performance and improving the human immune system. However, there is also a long-debating challenge for the effectiveness and risks of the use of these untraditional treatments or assisted interventions, including aromatherapy, meditation, yoga, music, waterfalls, and animal-assisted interventions. Aromatherapy has been found to be able to enhance people's relaxation and sleep quality in the 20th century, though the fragrance has been used in human society for more than 3500 years. Aroma oil, if used properly, can affect humans' brain status, behaviors, and emotions. Meditation and yoga have been evidenced by practitioners' experiences of being able to rewrite the brain and raise the spirit to reach joyfulness. Through the procedural practice of breathing, posture, and physical stretching, health benefits such as improved sleep, attention, focus, and reduced stress and menstrual disorders are gained. Animal-assisted interventions (AAIs) promote human health by training animals, such as dogs or cats, to accompany patients or isolated elderly people and help them return to social activities. AAIs have been found to be very effective in assisting in the treatment of dementia and depression.

Secondly, a systematic mechanism can be used to reach an equilibrium between economic development and human health. It is inevitable to produce pollution during product manufacturing. In addition to developing new technology for eliminating pollution, a systematic pollution analysis system is viable to avoid getting exposed to pollution. Such a system should be able to conduct the analysis tasks, including pollution monitoring, forecasting of trajectories and concentrations, spatiotemporal changing analysis, pollution pattern matching, and pollution control strategies. Last but not least, to assure a robust



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social security system, quality medical treatment should be maintained at a reasonable cost, which can be facilitated by an intelligent system for medical insurance audition such that the medical resources are not wasted or improperly used. The technology for natural language processing (NLP) has advanced rapidly in recent years; both accuracy and the amount of processed language data have greatly increased compared to before. The patients' medical history and insurance claims can be parsed by NLP technology to avoid resource waste or improper claims.

All in all, the inevitable rapid industrial development produces pollution for our environment, and the associated vibrant socioeconomic activities give people overwhelming stress. These challenges also create opportunities for the birth of new industries. This Special Issue aims to collect quality scientific contributions to the emerging industry of human performance and health promotion. To augment the readership of this Special Issue, we worked in collaboration with reputable conferences such as the 2021 International Conference on Emerging Industry and Health Promotion (EIHP2021), held at the National Chi Nan University, Nantou, Taiwan, on 3 July 2021, and the 2022 Information Technology and Applications Conference (ITAC2022), held at the China University of Technology, Taipei, Taiwan, on 16 March 2022. In the following sections, we comment on the five articles in this Special Issue that offer insights on this direction.

2. Aromatherapy for Promoting Human Performance and Health

The paper, authored by S. Thangaleela, B. S. Sivamaruthi, P. Kesika, M. Bharathi, W. Kunaviktikul, A. Klunklin, C. Chanthapoon, and C. Chaiyasut, presented a thorough review of using essential oils, phytoncides, aromachology, and aromatherapy for healing various physical and mental diseases [1]. In collecting the references for review, the keywords 'aromachology', 'aromatherapy', and 'aromatherapy and phytoncides' were used to search the most relevant articles published until 2021 in major scientific databases, namely, PubMed, Google Scholar, Medline, and PsycINFO. In total, 3967 English abstracts and articles were retrieved for subsequent screening and eligibility checks. Finally, 91 full-text articles were carefully perused for the review paper.

In this review paper, the evolution of research related to phytoncides containing essential oils in treating various ailments is elucidated. Phytoncides have effective functionalities in healing various diseases, such as treating periodontal disease and bad breath, executing anti-fungal effects, and reducing oral biofilm deposition in dental base resin. Many monoterpenes in pine tree essential oils have been reported to have anti-cancer properties. Essential oils have been used in therapies for treating insomnia, anxiety, depression, dental problems, stress, and high blood pressure, to name a few. There is practical evidence showing that aroma converts into olfactory signals, and the olfactory signals relieve physical and mental illness. However, it still needs validation from more studies conducted with sound technologies. The "back to nature" trend has created opportunities for emerging industries of health promotion using aromatherapy.

The second paper, authored by M. H. Ke, K. T. Hsieh, and W. Y. Hsieh, explored the application of aromatherapy to the physical and mental health and pressure of the middle-aged and elderly in the community [2]. The experiments were conducted with five distinct groups: Group A (compound essential oil massage plus sniffing), Group B (compound essential oil massage), Group C (pure base oil massage), Group D (compound essential oil sniffing), and control Group E (without any aromatherapy intervention). After the experiment executions, the participating elderly were requested to complete the Mental and Physical Health Scale form and the Stress Index Measurement Scale form. The result from the collected data for Group A, Group B, and Group D showed significant differences in "stress" before and after using aromatherapy, while the statistical test obtained for Group C and Group E did not reach a significant level. The result indicated that aromatherapy interventions can significantly improve the physical and mental health of the elderly and reduce their stress.

3. Air Pollution Analysis for Mitigating Environmental Threats

The urbanization and industrialization processes in human history have inevitably exacerbated the scale of pollution in both quantity and area. The mass of PM_{2.5} (particulate matter with an aerodynamic diameter $\leq 2.5 \mu\text{m}$) generated from natural and anthropogenic activities drifts into the air and even infiltrates into buildings. Many studies have shown the significant relationships between ambient PM_{2.5} concentrations and human illness, such as respiratory diseases, cardiovascular diseases, and cancers. The World Health Organization (WHO) has reported that ambient PM_{2.5} emissions were estimated to cause 4.2 million premature deaths worldwide in 2019 ([https://www.who.int/en/news-room/fact-sheets/detail/ambient-\(outdoor\)-air-quality-and-health](https://www.who.int/en/news-room/fact-sheets/detail/ambient-(outdoor)-air-quality-and-health), accessed on 26 May 2024). In addition to the impact on human lives, PM_{2.5} concentrations spoil the natural environment, leading to climate change, atmospheric visibility, and plant species mortality. In order to reach an equilibrium between socioeconomic development and environmental sustainability, several core actions to facilitate the Sustainable Development Goals (SDGs) (<https://www.un.org/sustainabledevelopment/blog/2015/08>, accessed on 26 May 2024), such as sustainable cities and communities, responsible consumption and production, and climate action, have taken place around the globe. The essential foundations for the success of these core actions are advanced technologies for developing green production, clean energy, and new ways of social interaction. In 2019, a new technology, termed computational sustainability, emerged. It aims to build an ecosystem of socioeconomic activities, natural species, and environmental conservation for a sustainable future by applying computational approaches. With the recent rapid advance of artificial intelligence, computational sustainability is a promising solution.

We chose two articles that proposed computational sustainability approaches for spatiotemporal analysis and forecasting of PM_{2.5} concentration. The paper, authored by P. Y. Yin, presented a novel spatiotemporal analysis framework for air pollution episode association in Puli, Taiwan [3]. The innovations in this paper rely on the use of video processing techniques that have never been applied to air pollution analytics. There is a great analogy between the episodes of PM_{2.5} concentration properties and the shots of video scenes. The studied field is resolved into a mesh of grids. The monitored PM_{2.5} hourly concentration at a grid is considered its gray intensity, such that a PM_{2.5} image is obtained every hour, which collectively generates a PM_{2.5} video for a time span. By applying the shot boundary detection technique, the PM_{2.5} video is segmented into pollution episodes. Each episode corresponds to particular PM_{2.5} properties, such as pollution concentration, transportation, scattering, and diminishing, in different spatiotemporal ways. The authors then applied clustering algorithms to group similar episodes, but appearing in different spatiotemporal spaces, in the same class. The experimental results manifest that the episodes contained in the same class have quasi-homogeneous patterns but appear at different times in a year. This means that some particular patterns of pollution activities appear many times in this region, which may have relations with local weather, terrains, and anthropogenic activities that are worthy of study in the future.

The second paper, authored by P. Y. Yin, R. I. Chang, R. F. Day, Y. C. Lin, and C. Y. Hu, introduced a new PM_{2.5} concentration forecasting technique by recognizing a particular meteorological phenomenon, termed temperature inversion [4]. There is a relationship between PM_{2.5} concentration and the formation of temperature inversions. The process of temperature inversion traps the convection of the surface air below the warm-air cap and increases the mass of the PM_{2.5} concentration. The paper applied CART, an advanced decision tree algorithm, to classify the days contained in a time series as either with or without manifesting temperature inversion. Two training datasets are prepared by grouping the days having the same classification label in a dataset. A separate multivariate regression model is trained for each dataset in order to improve PM_{2.5} forecasting accuracy.

4. NLP for Reducing the Deduction Rate of Health Insurance Claims

The paper by S. C. Su, C. C. Huang, R. R. Gung, L. K. Hsiung, Z. W. Gao, and C. E. Tsai gave insights into building prudent strategies for avoiding overuse or unnecessary use of medicines and medical examinations [5]. The national health insurance (<https://www.nhi.gov.tw/en/mp-2.html>, accessed on 26 May 2024) practiced by the Taiwan government has been recognized as one of the most successful public health administrations in the world. The patients can be treated with high-quality medical services at an affordable cost. However, this enjoyable service also gives opportunities to misuse or excessively use precious medical resources. The government agent of national health insurance executes an audit on the insurance claims submitted from hospitals and deducts the weight of the claims if some medical resources were found inappropriately used. To reduce the health insurance claim deduction rate for the hospital, the authors suggested in their paper that this sort of misconduct in hospitals can be mitigated by an artificial intelligence approach. A specific NLP model named latent Dirichlet allocation (LDA) was applied to analyze patients' medical records based on a large medical knowledge corpus. The LDA-derived factors are used as features for logistic regression to estimate the probability of each insurance claim being deducted. If the deduction probability is low, the claim can be submitted. Otherwise, the claim must be reviewed and modified based on the system's suggestions. This mechanism enhances the quality of medical insurance claims and reduces the deduction rate of the claim application from government agents.

5. Research Opportunities and Challenges

The articles published in this Special Issue presented various insights on emerging industries for the promotion of human performance and health. Beyond the discussions in these articles, there are research opportunities and challenges. Firstly, more experts from practitioners and academics are needed to participate in this cross-disciplinary research field of aromatherapy. It requires solid and technically sound validation processes to convince the public of its effectiveness and security. This also applies to other forms of assisted inventions, such as music, meditation, or animals. Secondly, the advent and rapid progress of artificial intelligence do create abundant opportunities for air pollution analytics. However, these techniques provide indirect proof for identifying the influential factors resulting in air pollution. The direct proof using the apportionment of the pollutants still needs to be analyzed in a chemical way, which is time-consuming and expensive. New technologies need to be developed to invent low-cost and fast-time apportionment-examining equipment. Thirdly, the high prediction accuracy of the reduction probability for a submitted health insurance claim depends on the quality of the training set, which is established by applying LDA to extract factors from the patients' medical records. Different hospitals may have a distinct in-house format for tallying medical history. It is a challenge to standardize the format for recording patients' medical histories in all hospitals. A solution to this goal may be to seek assistance from a government agent of the national health insurance administration to enforce standardization of audit documents for eligible hospitals claiming medical insurance.

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