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Product Colour Variation Management with Artificial Intelligence

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ABSTRACT

This research focuses on the topic of using AI in color variant management in products to enhance the appeal and performance of the products in the marketplace by incorporating artificial intelligence, deep learning, and neural network systems. Real-time consumer and product information, preferences, buying history, and sales history; I created an AI model to predict and change product colors in real-time. The complete workflow used comprises data gathering, processing, and feature extraction, model training, integration of the color adjustment software tools, and finally, testing and validation. The efficiency of such AI-driven interventions was analyzed through the consumer satisfaction indices, the sales results, and the engagement data based on the consumption of digital platforms. This study demonstrates valuable potential of AI to improve product design application and development while providing valuable suggestions for Businesses adapting and improving market outcomes according to the changing consumer trends. Such an application of AI implements a new best practice in ways of enhancing futuristic consumer-oriented marketing approaches. The paper was first completed in 2021 and later I have modified the paper with latest updates till date 2024.

INTRODUCTION

In this age of AI and machine learning, it has become much easier to interact with any problem. The use of AI has expanded in various fields over the last decade (Fuentes *et al.*, 2020). As a result of a lot of research and development, AI is now intimately involved with our lives. Large businesses such as trading, finance, healthcare, marketing, manufacturing is mainly dependent on AI (Wan *et al.*, 2020). According to a survey, by 2020, AI will be able to do 80% of any intellectual work. AI-related investments have been growing rapidly over the last few years (Walk *et al.*, 2023). According to a report prepared by Money-Tree in 2020, about $16.5 billion has been raised for 695 AI-related projects in 2019. Many smaller companies also now use paid AI services for fraud detection and process optimization. Now fortunately machines can learn a lot quicker than a normal human being (Yan *et al.*, 2023). With the help of Artificial Intelligence and Machine Learning, the machine can easily identify all the things that people cannot do in a smart way (Kumar *et al.*, 2023). The use of AI in digital marketing has made marketing much more affordable than ever before (Mariani *et al.*, 2023).

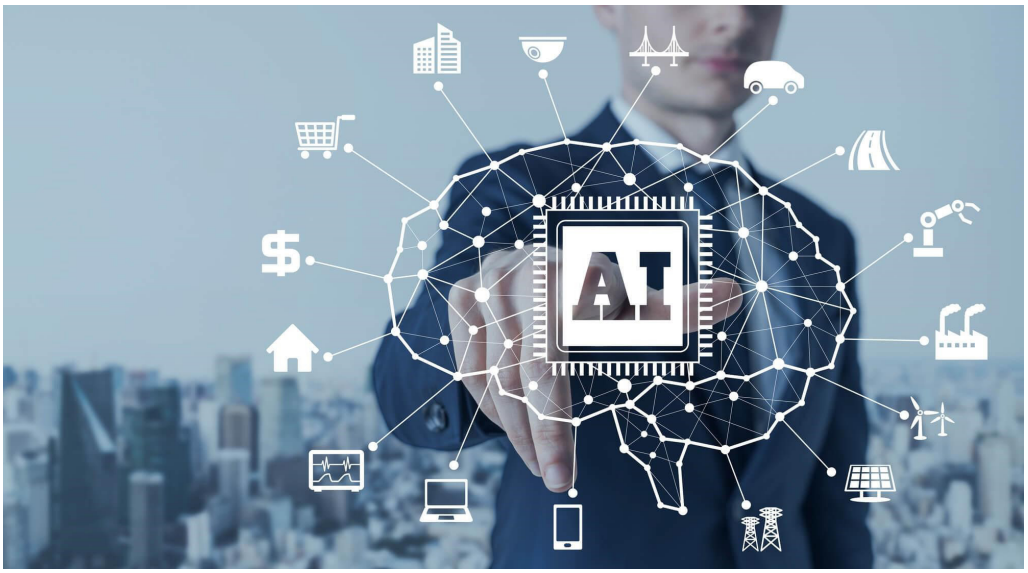

Figure 1: Use of AI

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LITERATURE REVIEW

AI has brought unprecedented changes in product design and product development (Kumar *et al.*, 2023). In the traditional way, before manufacturing the product, one had to rely entirely on humans for design and development (Mercan *et al.*, 2023). So, they had to go through a lot of trials and errors. It was difficult to succeed in the initial stage, even with a lot of investment. The main problem was to have no idea in advance what the demand for a new product might be and to analyses why a product fails if it fails (Omari *et al.*, 2018). It has been observed that all the start-ups have taken the help of AI in the field of product design and marketing at a very early stage, and they have got more success than others (Wang *et al.*, 2023).

Use of AI to Detect Customer Interest

Whether we like a product depends a lot on our emotions, the environment, our social status, and economic status. The effects of all these factors vary from person to person. So, it is not possible to accurately analyze all these factors with humans. AI can easily analyze all these factors (Sun *et al.*, 2019). Considering all these factors, AI tells us what kind of product should be promoted to whom. As a result, the rejection rate of a product decreases a lot, and the acceptance rate goes out. Similarly, if the rejection rate of a product increases, AI gives us an idea of where to change those products (Tobar *et al.*, 2024).

Color Detection with AI

Compare it with its preloaded data. After comparing it

Figure 2: Color Detection with AI

can decide the color of the product. If it detects some unknown color, then generally it tries to decide it by accessing data from other sources (Mahmood *et al.*, 2012).

METHODOLOGY

This study aimed at exploring how AI is utilized in dealing with product color differences with this objective in mind, this study incorporated several approaches that included machine learning, and neural networks. The main aim was to determine the best approach to choosing colors that are appropriate in product design and development with the intention of increasing consumers' satisfaction and therefore improving the market position. It includes consumer data that were preferences and previous purchase behavior acquired through questionnaires and web analytics, and product data that provide information on previous color fluctuations and sales history (Alexopoulos *et al.*, 2020). The process contained in the analysis phase included data cleaning and preparation where color data was normalized, and categorical variables encoded. Variable selection defined attributes that may affect color choices, including age, previous purchases and changing seasons. For the color analysis we trained machine learning models to learn the relationship between product colors and customer preferences to employ the appropriate algorithm for predictive analysis and image recognition (Ashta *et al.*, 2021). Another significant step in our approach was integrating AI and applying it in tools such as color prediction, which allowed us to predict the most popular color variation for new products based on analyzed indicators. Moreover, real-time color alteration mechanisms were included in e-commerce sites to execute dynamic changes based on the immediate customer feedback.

Findings

The product color is one of the most important things in product design and product development. But most product managers do not give importance to this matter. Many products are not acceptable to many customers because they do not like the color of the product. It has been seen that just by changing the color of the product, it is possible to increase the sales rate of the product a lot. So, like other things, we must focus on product color (Niazi *et al.*, 2019). We need to do a lot more research on how the color of the product affects the human mind. AI will help us in this subject.

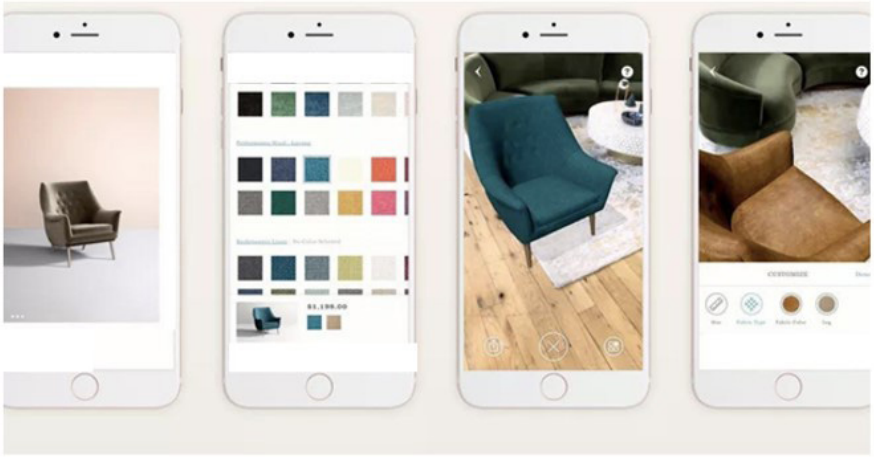

Figure 3: Product Color Variation

Augmented Reality in Shopping Processes

Augmented Reality can totally change our conventional shopping processes. Recently, some e-commerce companies have started using it experimentally.

Changing the Color Product Considering the Environment

Which color's product to use in which environment can be easily determined using augmented reality. Like you have a garden. You can easily determine if you want to place a bench in that garden using augmented reality. You can visualize which color will be best for you with augmented reality (Xu *et al.*, 2024).

House Furniture Planning

Augmented Reality is highly effective for house furniture planning. Using augmented reality, you can clearly visualize what color furniture you like in which room. This reduces the chances of ordering the wrong furniture by 60% (Kasyap & Tiwari).

Beauty Products Shopping with AR

AI has also revolutionized the field of cosmetic shopping. In a joint venture with L'Oréal, Amazon has come up with the idea of bringing augmented reality for buyers. It is believed that this will add a new dimension to the purchase of beauty products (Wang *et al.,* 2023). For example, if you want to buy lipstick online but do not understand what color lipstick to buy. In this case, AR will suggest the best color depending on your skin color and lip shape (Holzinger *et al.,* 2019). Personalized experience & possibility to conduct themed parties: Imagination and creativity are the two main issues in theme party arrangement. And augmented reality is especially effective in both cases. You can visualize a party before it happens.

Helping Manufacturers with AR

AR technology is a very necessary technology for any product design and development. AR helps to understand what the product will look like before manufacturing any product (Chairat *et al.,* 2023). Which is very necessary.

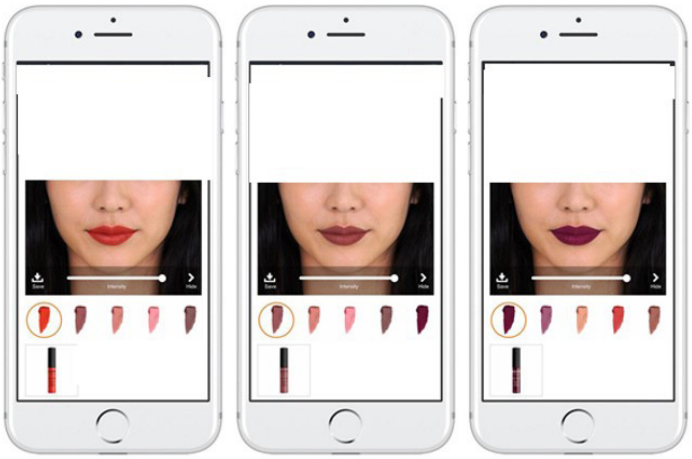

Figure 4: Helping manufacturers with AR

However, to use this type of technology, manufacturers need to be given the right guides and tools so that they can make more advanced products (Pathan *et al.* 2020).

Product Color Variation Management with AI

Benefits of Product Color Variation Management with AI in Physical Products

The color we like usually has a huge impact on all the physical products we use. Assume you go to a store to get some items. The store has 3 different color water bottles of a brand. Now if you like the color blue, there is a 90% guarantee that you will buy a blue water bottle. In this way, color variation affects the selling rate of the product. Now if a brand makes a product of similar color, its sales rate may decrease. AI helps us in this field.

Suppose you own a T-shirt store. Now if you take the help of AI in selling the product, how will it help you? AI will first identify the person who comes to your store through face recognition and then save the information of the color of the T-shirt that the person has taken during the product scan. Then when that person enters your store for the second time, the AI will suggest the name and the color of some T-shirts to your employees according to the information obtained from the previous one. Thus, AI will give more perfect advice to you. Remember that data is the Nutrition of AI. If you put more information to AI, it will work more precisely and can predict more accurately.

Application of Product Color Variation with AI in the Field of E-Commerce

AI is particularly important for e-commerce sites. In the case of online selling, it is easier to track customers. For example, a customer has ordered different things from your e-commerce site at different times. AI has saved all the information from those orders such as the color and size of the product, etc. Now, whenever that person comes to your site, the AI-based application system will show him different products according to the previous choice.

Also, many customers come with product reviews and feedback. The AI-based application system will use that data to give you information on what needs to be changed in the product. For example, if most of the customers have bought a product in red color, now they are looking for the same product in pink color, then AI will give you a notification to bring variation in the product color. Information about which product and what color product is being used the most is available from the order details. AI gives us various information using all that data. By targeting those locations, you can run the right product campaign at an extremely low cost.

Changes can be seen in the utilization of various items relying upon the season. Again, during special festivals, the demand for products of any color increases. At the point when a mainstream film or TV series is released, the interest in certain colors and products also increases. Currently, if you bring variation in product color, the sales rate increases a lot. At this time AI suggests to us according to the information received from different sources what kind of color variation should be brought in the product.

Benefits of Product Color Variation Management with AI in Digital Products

AI has made a huge contribution to the revolution of digital products. AI has made it much easier to use digital products these days. Day by day the use of digital products is becoming so much more enjoyable for the sake of AI. Color variation is particularly important for digital products (Cooper, 2023). It is particularly important to bring color variation in digital products depending on different needs at different times. Suppose you have a website, and you use a theme of your choice on that web site. That website also has particularly good content. But visitors to the website are not coming or spending little time (Cooper, 2024). One explanation behind this might be that the tones you use on the site are not utilized appropriately.

Now you can change the color of the header or the color of the footer and see a lot more views coming to your website. And this often happens. In fact, the color we use in the header and footer of the website, or the theme color we use has a huge impact on the viewers. AI will advise you which color you should use, or the AI will change the color of the website according to the color that the viewer wants to see. In this case, the AI system will ask for the user's opinion using the pop-up.

Almost every popular app we use collects all the information about our likes and dislikes using AI. For example, if you use a food delivery app, it will notify you when it is raining that "it is raining today so order some snacks". If we see the same design and color for a long time, usually our vision becomes saturated, that is, the design or color does not arouse any feeling in us after a long time (Singler, 2020). For this, we get bored if we use some app for a long time. So, some big companies using AI can understand if their app has reached the vision saturation zone. And accordingly, they can change their product design and color so that we can get rid of our monotony (Hermann, 2023).

In this way, color variation with the help of AI helps to increase the number of users of digital products. Popular messaging and chatting apps try to entertain users with emoji's of different colors. AI determines what emoji's need to be brought next, depending on which emoji's are being used the most. There is also a system to change the theme color in different apps (Manovich, 2021). Video streaming giants YouTube, Netflix have spread dominance today. So, it is practically difficult to rival all these applications. In this situation, any new video streaming application can utilize AI to expand the number of quality clients (Bhavana *et al.*, 2021). In this case, the weapon can be a product color variation. They must ring different color modes. If the user using AI can watch the video in the mode of their choice, it can be a different experience.

Product color variation is particularly important for any ed-tech app or website. For example, the color variation is particularly important in the user interface that is created for nursery or kindergarten students. It is advisable to

use different color of user interfaces at different times (Muratbekova *et al.,* 2024). AI can help you with this process. In this way, their attention span can be increased a lot, and education will also be much more entertaining for students. Different types of online tools can use this color variation technique with AI to increase customer interest (Subramonyam *et al.*, 2021). To use this kind of innovation we must get out of traditional marketing techniques. We should rely on AI & cloud-based technologies in terms of product design, product manufacturing, and marketing.
For any survey, you need to use an AI-based app to get much more reliable information.

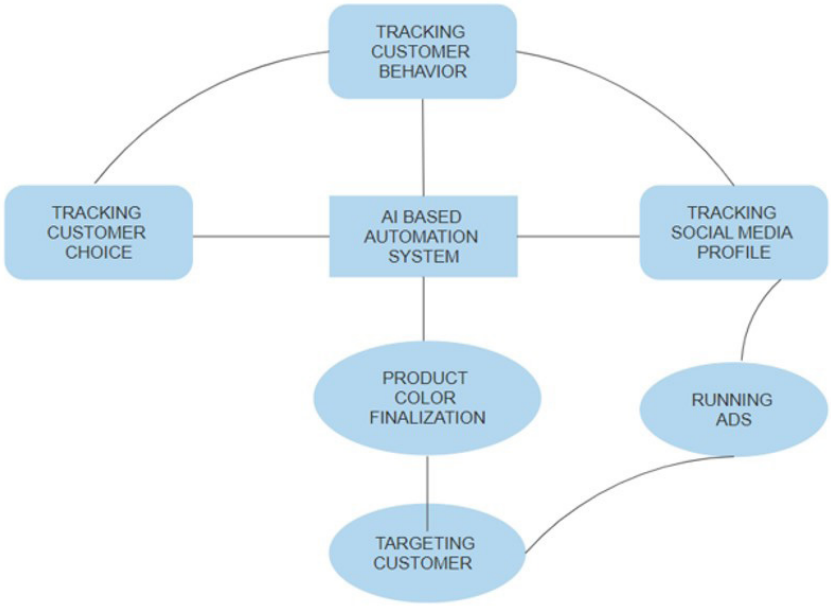

Figure 5: Survey use an AI-based applications

Product Color Variation with AI and Human Emotion
Our emotions are a big factor in buying a product. The impact of color will be huge on people emotions. So, emotion tracking, and emotion hacking is a particularly important issue in product design and development (Ding *et al.,* 2021). By emotion tracking, we mean that when a customer buys a product, if he buys the product of the same color again and again, then we can understand that the person has a passion for that color. This is emotion hacking (Quan *et al.,* 2023). Now when we launch a new product, we will promote the product of that color to him and try to sell it at a special price. Now that person is most likely to buy that product.
AI helps us with emotion hacking and tracking. In this way, even if our customer is addicted to a new color, our AI system will inform us about that. As a result, we can bring variation in the color of our product without any hassle. This creates long-lasting (Schrills *et al.,* 2020). Customer bonding and reduces product rejection overnight. Mass-trust can be easily created by adopting this method. It also helps a lot with product marketing.

Advantages of Product Color Variation with AI
So, we can see that product color variation management is much easier with the help of AI. Not just that, it is vital to utilize this technique at whatever point we launch a product. The complex undertakings like, product design & development, marketing research can be improved (Nabwire *et al.*, 2021). As a result, product launching can be done very easily. Good results in reselling can be obtained by retargeting the customer using this method. This process is highly effective for all digital and physical products. As the use of digital products increases over time, variations in product color are needed to maintain the acceptability of those products. We need more research and development to take this field forward (Luo *et al.*, 2022). Although it does not have many disadvantages, it has some limitations. Since product color variation technology with AI has not been used in many cases yet, AI-based product color variation technology is not yet affordable (Ignatov *et al.*, 2017). As it is a new technology, it is often not possible to execute properly in the workplace.

CONCLUSION

In conclusion, we can say that product color variations with AI are particularly important from product design and product development to manufacturing marketing. It is estimated that by 2050, 80% of companies will have fully shifted to this technology. This technology is going to be the best strategy to increase revenue. Starting from the e-commerce sector to health care management, ed-tech, and all major sectors are utilizing this technology to grow their revenue. As the utilization of computerized items increases over the long haul, varieties in item tone are expected to keep up the adequacy of those items. We need more innovative work to take this field forward.
The application of AI in product color variation

management has disclosed the high possibility of changing the approaches to product design and development. In this context, the present research has adopted innovative machine learning techniques such as neural networks and new formulae to forecast and rectify color deviations and thereby streamline it in correspondence with the consumer preferences and market conditions. fulfilment color adjustment tools applied to e-commerce have created means for the dynamic color change, which has improved customer fulfillment and interaction. The evidence provided emphasizes the role of AI in influencing product management innovation, implying that businesses utilizing AI-tainted initiatives will be much more adaptable and competitive in the market. This paper brings about the same message that has been echoed in earlier studies on how AI has revolutionized modern business practices, particularly in the customer-oriented sectors.

REFERENCES

Alexopoulos, K., Nikolakis, N., & Chryssolouris, G. (2020). Digital twin-driven supervised machine learning for the development of artificial intelligence applications in manufacturing. *International Journal of Computer Integrated Manufacturing, 33*(5), 429–439. https://doi.org/10.1080/0951192X.2020.1747642

Ashta, A., & Herrmann, H. (2021). Artificial intelligence and fintech: An overview of opportunities and risks for banking, investments, and microfinance. *Strategic Change, 30*(3), 211–222.

Beaird, J., & Walker, A. (2020). *The principles of beautiful web design*. SitePoint Pty Ltd.

Bartlett, K. A., & Camba, J. D. (2024). Generative artificial intelligence in product design education: Navigating concerns of originality and ethics. *International Journal of Artificial Intelligence and Machine Learning, 13*(2), 123–135. https://doi.org/10.9781/ijimai.2024.02.006

Bhavana, D., Kumar, K. K., Chandra, M. B., Bhargav, P. S., Sanjanaa, D. J., & Gopi, G. M. (2021). Hand sign recognition using CNN. *International Journal of Performability Engineering, 17*(3), 314. https://www.ijpe-online.com/EN/10.23940/ijpe.21.03.p7.314321

Bhavana, D. (2021). Computer vision, human senses, and language of art. *AI & Society, 36*(4), 1145–1152. https://doi.org/10.1007/s00146-020-01094-9

Cooper, R. G. (2024). The AI transformation of product innovation. *Industrial Marketing Management, 119,* 62–74.

Cooper, R. G. (2023). The artificial intelligence revolution in new-product development. *IEEE Engineering Management Review*. Advance online publication.

Chairat, S., Chaichulee, S., Dissaneewate, T., Wangkulangkul, P., & Kongpanichakul, L. (2023). AI-assisted assessment of wound tissue with automatic color and measurement calibration on images taken with a smartphone. *InHealthcare, 11*(2), 273. https://doi.org/10.3390/healthcare11020273

Ding, M., Cheng, Y., Zhang, J., & Du, G. (2021). Product color emotional design based on a convolutional neural network and search neural network. *Color Research & Application, 46*(6), 1332–1346. https://doi.org/10.1002/col.22668

Fuentes, S., Torrico, D. D., Tongson, E., & Gonzalez Viejo, C. (2020). Machine learning modeling of wine sensory profiles and color of vertical vintages of Pinot Noir based on chemical fingerprinting, weather, and management data. *Sensors, 20*(13), 3618. https://doi.org/10.3390/s20133618

Holzinger, A., Langs, G., Denk, H., Zatloukal, K., & Müller, H. (2019). Causability and explainability of artificial intelligence in medicine. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery, 9*(4), e1312. https://doi.org/10.1002/widm.1312

Hermann, I. (2023). Artificial intelligence in fiction: Between narratives and metaphors. *AI & Society, 38*(1), 319–329. https://doi.org/10.1007/s00146-021-01299-6

Ignatov, A., Kobyshev, N., Timofte, R., Vanhoey, K., & Van Gool, L. (2017). DSLR-quality photos on mobile devices with deep convolutional networks. In *Proceedings of the IEEE International Conference on Computer Vision* (pp. 3277–3285). https://doi.org/10.48550/arXiv.1704.02470

Kasyap, C. S., & Tiwari, S. (Year). Crop management using artificial intelligence: A literature survey.

Kumar, I., Rawat, J., Mohd, N., & Husain, S. (2021). Opportunities of artificial intelligence and machine learning in the food industry. *Journal of Food Quality, 2021,* 1–10. https://doi.org/10.1155/2021/4535567

Luo, G., Yuan, Q., Li, J., Wang, S., & Yang, F. (2022). Artificial intelligence powered mobile networks: From cognition to decision. *IEEE Network, 36*(3), 136–144. https://doi.org/10.48550/arXiv.2112.04263

Mercan, Ö. B., Kılıç, V., & Şen, M. (2021). Machine learning-based colorimetric determination of glucose in artificial saliva with different reagents using a smartphone-coupled µPAD. *Sensors and Actuators B: Chemical, 329,* 129037. https://doi.org/10.1016/j.snb.2020.129037

Mahmood, T., Arsalan, M., Owais, M., Lee, M. B., & Park, K. R. (2020). Artificial intelligence-based mitosis detection in breast cancer histopathology images using Faster R-CNN and deep CNNs. *Journal of Clinical Medicine, 9*(3), 749. https://doi.org/10.3390/jcm9030749

Mariani, M. M., Machado, I., Magrelli, V., & Dwivedi, Y. K. (2023). Artificial intelligence in innovation research: A systematic review, conceptual framework, and future research directions. *Technovation, 122,* 102623. https://doi.org/10.1016/j.technovation.2022.102623

Muratbekova, M., & Shamoi, P. (2024). Color-emotion associations in art: Fuzzy approach. *IEEE Access*. Advance online publication. https://doi.org/10.48550/arXiv.2311.18518

Nabwire, S., Suh, H. K., Kim, M. S., Baek, I., & Cho, B. K. (2021). Application of artificial intelligence

in phenomics. *Sensors, 21*(13), 4363. https://doi.org/10.3390/s21134363

Niazi, M. K., Parwani, A. V., & Gurcan, M. N. (2019). Digital pathology and artificial intelligence. *The Lancet Oncology, 20*(5), e253–e261. https://doi.org/10.1016/S1470-2045(19)30172-7

Omari, A., Behroozi-Khazaei, N., & Sharifian, F. (2018). Drying kinetic and artificial neural network modeling of mushroom drying process in microwave-hot air dryer. *Journal of Food Process Engineering, 41*(7), e12849. https://doi.org/10.1111/jfpe.12849

Pathan, M., Patel, N., Yagnik, H., & Shah, M. (2020). Artificial cognition for applications in smart agriculture: A comprehensive review. *Artificial Intelligence in Agriculture, 4,* 81–95. https://doi.org/10.1016/j.aiia.2020.06.001

Quan, H., Li, S., Zeng, C., Wei, H., & Hu, J. (2023). Big data and AI-driven product design: A survey. *Applied Sciences, 13*(16), 9433. https://doi.org/10.3390/app13169433

Singler, B. (2020). The AI creation meme: A case study of the new visibility of religion in artificial intelligence discourse. *Religions, 11*(5), 253. https://doi.org/10.3390/rel11050253

Subramonyam, H., Seifert, C., & Adar, E. (2021). Towards a process model for co-creating AI experiences. In *Proceedings of the 2021 ACM Designing Interactive Systems Conference* (pp. 1529–1543). https://doi.org/10.1145/3461778.3462012

Sun, Q., Zhang, M., & Mujumdar, A. S. (2019). Recent developments of artificial intelligence in drying of fresh food: A review. *Critical Reviews in Food Science and Nutrition, 59*(14), 2258–2275. https://doi.org/10.1080/10408398.2018.1446900

Schrills, T., & Franke, T. (2020). Color for characters: Effects of visual explanations of AI on trust and observability. In *Artificial Intelligence in HCI: First International Conference, AI-HCI 2020, Held as Part of the 22nd HCI International Conference, HCII 2020, Copenhagen, Denmark, July 19–24, 2020, Proceedings* (Vol. 22, pp. 121–135). Springer International Publishing. https://doi.org/10.1007/978-3-030-50334-5_8

Tobar, M. D., Clemann, S., Hagens, R., Pagel-Wolff, S., Hoppe, S., Behm, P., Engelhard, F., Langhals, M., Gallinat, S., Zhavoronkov, A., & Georgievskaya, A. (2024). Skinly: A novel handheld IoT device for validating biophysical skin characteristics. *Skin Research and Technology, 30*(3), e13613. https://doi.org/10.1034/j.1600-0846.2000.006004230.x

Wan, J., Li, X., Dai, H. N., Kusiak, A., Martinez-Garcia, M., & Li, D. (2020). Artificial-intelligence-driven customized manufacturing factory: Key technologies, applications, and challenges. *Proceedings of the IEEE, 109*(4), 377–398. https://doi.org/10.48550/arXiv.2108.03383

Wang, B., Li, Y., Zhou, M., Han, Y., Zhang, M., Gao, Z., Liu, Z., Chen, P., Du, W., Zhang, X., & Feng, X. (2023). Smartphone-based platforms implementing microfluidic detection with image-based artificial intelligence. *Nature Communications, 14*(1), 1–8. https://doi.org/10.1038/s41467-023-36017-x

Walk, J., Kühl, N., Saidani, M., & Schatte, J. (2023). Artificial intelligence for sustainability: Facilitating sustainable smart product-service systems with computer vision. *Journal of Cleaner Production, 402,* 136748. https://doi.org/10.1016/j.jclepro.2023.136748

Wang, B., Li, Y., Zhou, M., Han, Y., Zhang, M., Gao, Z., Liu, Z., Chen, P., Du, W., Zhang, X., & Feng, X. (2023). Smartphone-based platforms implementing microfluidic detection with image-based artificial intelligence. *Nature Communications, 14*(1), 1–8. https://doi.org/10.1038/s41467-023-36017-x

Xu, Q., Yan, R., Gui, X., Song, R., & Wang, X. (2024). Machine learning-assisted image label-free smartphone platform for rapid segmentation and robust multi-urinalysis. *Analytical and Bioanalytical Chemistry, 416*(6), 1443–1455. https://doi.org/10.1007/s00216-024-05147-6

Yan, L., Zhang, B., Zong, Z., Zhou, W., Shuang, S., & Shi, L. (2023). Artificial intelligence-integrated smartphone-based handheld detection of fluoride ion by Al^{3+}-triggered aggregation-induced red-emission enhanced carbon dots. *Journal of Colloid and Interface Science, 651,* 59–67. https://doi.org/10.1016/j.jcis.2023.07.125