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A genetic algorithm approach to design job rotation schedules ensuring homogeneity and diversity of exposure in the automotive industry

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Abstract:

Job rotation is a work organization strategy with increasing popularity, given its benefits for workers and companies, especially those working with manufacturing. This study proposes a formulation to help the team leader in an assembly line of the automotive industry to achieve job rotation schedules based on three major criteria: improve diversity, ensure homogeneity, and thus reduce exposure level. The formulation relied on a genetic algorithm, that took into consideration the biomechanical risk factors (EAWS), workers' qualifications, and the organizational aspects of the assembly line. Moreover, the job rotation plan formulated by the genetic algorithm formulation was compared with the solution provided by the team leader in a real life-environment. The formulation proved to be a reliable solution to design job rotation plans for increasing diversity, decreasing exposure, and balancing homogeneity within workers, achieving better results in all of the outcomes when compared with the job rotation schedules created by the team leader. Additionally, this solution was less time-consuming for the team leader than a manual implementation. This study provides a much needed solution to the job rotation issue in the manufacturing industry, with the genetic algorithm taking less time and showing better results than the job rotations created by the team leaders

Biography

Nafiseh Mollaei holds a Ph.D. in Biomedical Engineering. She is an expert in a wide variety of AI algorithms like natural language processing and machine learning. As a part of her industry program, she has been working at Volkwagen Autoeuopa to predict occupational disorders in order to increase the productivity of the automotive sector. Besides, she has worked several articles in terms of the applicability of AI in this domain, such as subjects of Human_Centered Explanaible AI, Knowledge Discovery Exploratory based on association rules mining, and also Reinforcement Learning in Industry 5.0.

Presently, she has holder of post doctoral fellowship in Biosensors in Baylor Collage of Medicine, USA. She is working on Center to Stream Healthcare in Place (C2SHIP).



About Research Topic

A job rotation plan is an essential tool to the automotive industry and its aim is to facilitate not only the work of the team leader but also, in the long run, to reduce the risk associated with musculoskeletal injuries by increasing diversity, decreasing exposure, and ensuring homogeneity. The aim is to reduce the risk associated with musculoskeletal injuries. An algorithm generated a solution that took less time building a rotation plan, when compared with that of the team leaders. This could spare team leaders time for other important tasks.

About Institution:

The mission of the C2SHIP Center is to engage academic and industrial partners in joint efforts that develop healthcare technologies for in place care and accelerate innovation through multi_specialty collaborations. Emphasize fundamental investigations that provide an in depth understanding of the core disciplines needed for personalized technology that promotes in place care.

Establish effective interactions with Center members to promote innovation capacity and accelerate technology transfer. Promote collaborations with other existing centers to create multi_center innovative technology for the involved core disciplines.

References:

1. Aryanezhad MB, Kheirkhah AS, Deljoo V, Mirzapour Al_e_hashem SM. Designing safe job rotation schedules based upon workers' skills. The International Journal of Advanced Manufacturing Technology. 2009 Mar; 41(1):193-9.
2. Asensio_Cuesta S, Diego-Mas JA, Canós_Darós L, Andrés_Romano C. A genetic algorithm for the design of job rotation schedules considering ergonomic and competence criteria. The International Journal of Advanced Manufacturing Technology. 2012 Jun;60(9):1161_74.
3. Yung M, Mathiassen SE, Wells RP. Variation of force amplitude and its effects on local fatigue. European journal of applied physiology. 2012 Nov;112(11):3865-79.
4. Xu Z, Ko J, Cochran DJ, Jung MC. Design of assembly lines with the concurrent consideration of productivity and upper extremity musculoskeletal disorders using linear models. Computers & Industrial Engineering. 2012 Mar 1;62(2):431-41.
5. Mossa G, Boenzi F, Digiesi S, Mummolo G, Romano VA. Productivity and ergonomic risk in human based production systems: A job-rotation scheduling model. International Journal of Production Economics. 2016 Jan 1;171:471_7.
6. Durand MJ, Corbière M, Coutu MF, Reinharz D, Albert V. A review of best work-absence management and return-to-work practices for workers with musculoskeletal or common mental disorders. Work. 2014 Jan 1;48(4):579-89.
7. De Kok J, Vroonhof P, Snijders J, Roullis G, Clarke M, Peereboom K, van Dorst P, Isusi I. Work-related musculoskeletal disorders: prevalence, costs and demographics in the EU. European Agency for Safety and Health at Work. 2019 Jan;1.
8. Hochdörffer J, Hedler M, Lanza G. Staff scheduling in job rotation environments considering ergonomic aspects and preservation of qualifications. Journal of manufacturing systems. 2018 Jan 1;46:103_14.

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