A dynamic job-shop scheduling model based on deep learning

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ABSTRACT

Ideally, the solution to job-shop scheduling problem (JSP) should effectively reduce the cost of manpower and materials, thereby enhancing the core competitiveness of the manufacturer. Deep learning (DL) neural networks have certain advantages in handling complex dynamic JSPs with a massive amount of historical data. Therefore, this paper proposes a dynamic job-shop scheduling model based on DL. Firstly, a data prediction model was established for dynamic job-shop scheduling, with long short-term memory network (LSTM) as the basis; the Dropout technology and adaptive moment estimation (ADAM) were introduced to enhance the generalization ability and prediction effect of the model. Next, the dynamic JSP was described in details, and three objective functions, namely, maximum makespan, total device load, and key device load, were chosen for optimization. Finally, the multi-objective problem of dynamic JSP scheduling was solved by the improved multi-objective genetic algorithm (MOGA). The effectiveness of the algorithm was proved experimentally.

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Dinamični model terminiranja proizvodnje po naročilu, ki temelji na globokem učenju

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POVZETEK

V idealnem primeru bi morala rešitev težave terminiranja proizvodnje po naročilu (JSP) učinkovito zmanjšati stroške delovne sile in materialov ter s tem povečati konkurenčnost proizvodnega podjetja. Nevronske mreže, ki temeljijo na globokem učenju (DL), imajo nekatere prednosti pri ravnanju s kompleksnimi dinamičnimi JSP-ji z veliko količino zgodovinskih podatkov. Zato ta članek predlaga dinamični model terminiranja proizvodnje po naročilu, ki temelji na DL. Najprej je bil s pomočjo mreže dolgega kratkoročnega spomina (LSTM) postavljen model za napoved podatkov za dinamično terminiranje proizvodnje po naročilu; za izboljšanje zmožnosti posploševanja in učinka napovedovanja modela sta bili uvedeni tehnologija Dropout in prilagodljiva ocena zagona (ADAM). Nato je bil podrobno opisan dinamični JSP, za optimizacijo pa so bile izbrane tri ciljne funkcije, in sicer najdaljši čas izdelave, skupna zasedenost naprav in zasedenost ključne naprave. Nazadnje je bil večkriterijski problem dinamičnega JSP rešen z izboljšanim večkriterijskim genetskim algoritmom (MOGA). Učinkovitost algoritma je bila eksperimentalno dokazana.

PODATKI O ČLANKU

Ključne besede:

Dolgi kratkoročni spomin (LSTM);
Dinamično terminiranje proizvodnje po naročilu;
Večkriterijski genetski algoritem (MOGA);
Prilagodljiva ocena zagona (ADAM)

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