

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
12 October 2023 (12.10.2023)



(10) International Publication Number
WO 2023/195922 A1

(51) International Patent Classification:
G06N 10/80 (2022.01) *G06F 8/20* (2018.01)

(21) International Application Number:
PCT/SG2023/050226

(22) International Filing Date:
04 April 2023 (04.04.2023)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10202203429U 04 April 2022 (04.04.2022) SG

(71) Applicant: **ENTROPICA LABS** [SG/SG]; 186B Telok Ayer Street, Singapore 068632 (SG).

(72) Inventors: **SHARMA, Vishal**; 186B Telok Ayer Street, Singapore 068632 (SG). **DISILVESTRO, Leonardo**; 186B Telok Ayer Street, Singapore 068632 (SG). **NUR, Shahidee Bin Saharan**; 186B Telok Ayer Street, Singapore 068632 (SG). **CHIEW, Shao Hen**; 186B Telok Ayer Street,

Singapore 068632 (SG). **DEMARIE, Tommaso Federico**; 186B Telok Ayer Street, Singapore 068632 (SG). **MUNRO, Ewan Franek**; 186B Telok Ayer Street, Singapore 068632 (SG).

(74) Agent: **SPRUSON & FERGUSON (ASIA) PTE LTD**; P.O. Box 1531, Robinson Road Post Office, Singapore 903031 (SG).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CV, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IQ, IR, IS, IT, JM, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, MG, MK, MN, MU, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, WS, ZA, ZM, ZW.

(54) Title: METHODS, SYSTEMS AND KITS FOR QUANTUM-OPTIMIZED CROSS-BACKEND SOFTWARE DEVELOPMENT

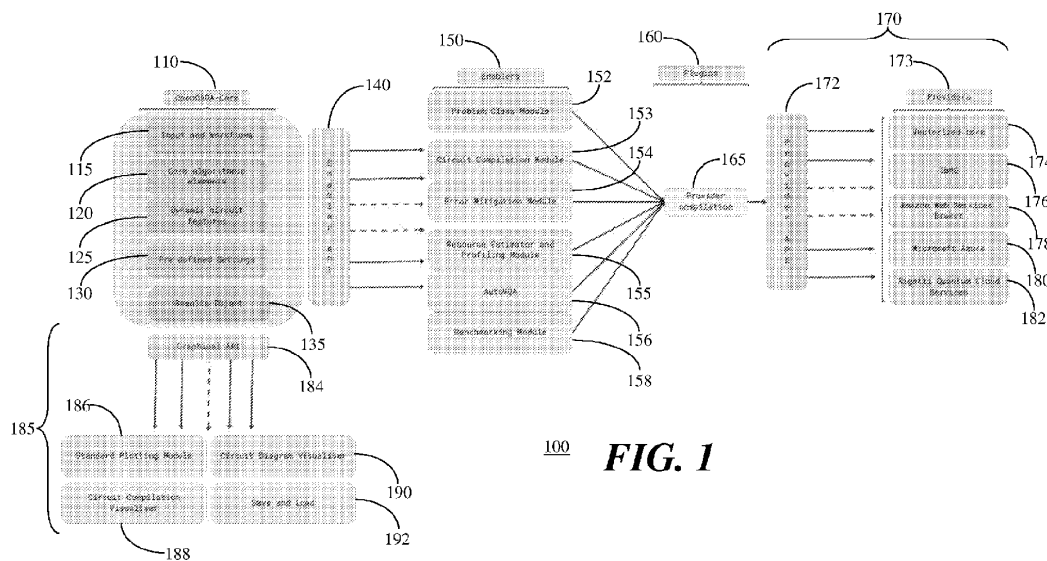


FIG. 1

(57) Abstract: Methods, systems and kits for quantum-optimized cross-backend software development are provided. According to at least one aspect of the present embodiments, a method for building quantum optimization algorithms that can run on quantum hardware is provided. The method includes receiving an input comprising a user-defined problem and at least one pre-defined Variational Quantum Algorithm (VQA) statement and converting the received input into a workflow. The method also includes obtaining an abstract Variational Quantum Algorithm (VQA) representation based on the workflow and creating a compiled, target-optimized backend specific quantum circuit based on the abstract VQA representation and returning a structured, contextual and indexable output, wherein the output comprises an optimization result and additional metadata.

[Continued on next page]

WO 2023/195922 A1

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*