

(43) International Publication Date
27 March 2025 (27.03.2025)



(10) International Publication Number
WO 2025/064722 A1

(51) International Patent Classification:

<i>G06F 16/33</i> (2025.01)	<i>G06F 40/40</i> (2020.01)
<i>G06F 40/205</i> (2020.01)	<i>G06N 3/09</i> (2023.01)
<i>G06F 40/35</i> (2020.01)	<i>G06N 5/02</i> (2023.01)

(21) International Application Number:

PCT/US2024/047558

(22) International Filing Date:

19 September 2024 (19.09.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

63/539,102 19 September 2023 (19.09.2023) US

(72) Inventor; and

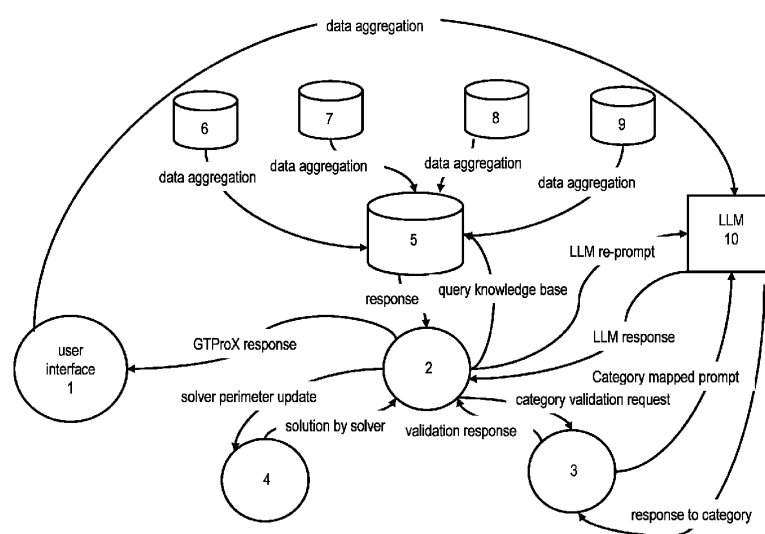
(71) **Applicant:** GE, Xiaolin [US/US]; 401 E. Brookwood Ct., Phoenix, Arizona 85048 (US).

(74) **Agent: FONTES, Timothy D.**; POLSINELLI PC, One E. Washington Street, Suite 1200, Phoenix, Arizona 85004 (US).

(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.

(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,

(54) Title: SYSTEMS AND METHODS FOR HYBRID ARTIFICIAL INTELLIGENCE ENHANCEMENT AND OPTIMIZATION



Data flow
FIG. 4

(S7) Abstract: Examples for validating and optimizing responses generated by large language models (LLMs) are disclosed. A multi-pronged approach includes implementation of a logic programming engine that parses the responses into verifiable logic predicates to detect contradictions against a real-world knowledge base. The responses can further be weighed for category validation by using category theory to model the responses as mathematical morphisms to identify semantic inconsistencies that may be indicative of false information associated with the responses. The responses can be modified and supplemented in view of the validation operations described.

[Continued on next page]

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).

Published:

— with international search report (Art. 21(3))