PATENT COOPERATION TREATY

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INTERNATIONAL SEARCHING AUTHORITY

To:

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PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2022/061405	28.04.2022	

International Patent Classification (IPC) or both national classification and IPC
INV. G06Q20/40 G06N3/04 G06Q10/06 G06Q40/02

Applicant
FEATURESPACE LIMITED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

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Date of completion of this opinion
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WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/EP2022/061405

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed.

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:

      ☐ in the form of an Annex C/ST.25 text file.

      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:

      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).

      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	2, 9-11, 15-20
	No:	Claims	1, 3-8, 12-14, 21-30
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-30
Industrial applicability (IA)	Yes:	Claims	1-30
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1 WO 2022/008130 A1 (FEATURESPACE LTD [GB]) 13 January 2022 (2022-01-13) cited in the application

D2 US 2021/248448 A1 (BRANCO BERNARDO JOSÉ AMARAL NUNES DE ALMEIDA [PT] ET AL) 12 August 2021 (2021-08-12)

1 **Independent claims**

1.1 Document D1 discloses (using the wording of claim 1):

A machine learning system (figure 6A) *for processing data corresponding to an incoming transaction associated with an entity* (figure 1, transaction processing system 100. Note that the incoming transactions are related to a certain transaction processing system, in at least as far as the transactions are to be processed by the transaction processing system)*, the machine learning system comprising a categorical history module* (figure 6A, module 620 - see further explanations below) *configured to process at least some of said data, the categorical history module comprising:*

i) a memory configured to store state data for a plurality of categories indexed by a respective category identifier, wherein the state data stored in the memory for each category identifier corresponds to a previous transaction associated with the entity and the respective category;

- para. 74: "the recurrent neural network architecture 620 is only “aware” of previous transactions for the same entity via the previous state vector for that entity"
- para. 80: "the state data used by the recurrent neural network architecture 620 is entity dependent, i.e. is specific to a particular user, account holder or merchant account..." and "...for each entity but may store state data separately and may only retrieve historical transaction data and/or ancillary data that is associated with (e.g., indexed by) that entity"

- Note that the "entity" as referred to by the above passages of D1, e.g. the buyer associated with a transaction are held to correspond to a *category* within the meaning of claim 1. Using the wording of claim 1, for a single entity (the payment processing system of D1), multiple states, one for each category (for each buyer of D1) are stored and correspondingly looked-up.

ii) a decay logic stage configured to modify state data stored in the memory based on a time difference between a time of the incoming transaction and a time of a previous transaction (figure 6B, showing the inner working of the module 620 in particular a forget gate 626; para. 78: "The recurrent neural network architecture 620 comprises a forget gate 626 to modify the state data for the previous iteration based on data output by the time difference input interface 606")*, said decay logic stage being configured to:*

a) when the memory contains state data for the entity and category identifier pair associated with the incoming transaction, retrieve said state data

- para. 80 as mentioned above: the fact that a state is retrieved as disclosed in para. 80 implies the memory contains a state as claimed

and apply a decaying function to the state data to generate a decayed version of the state data, wherein the decaying function is dependent on the time difference, and output the decayed version of the state data; and

- para. 95: "the forget gate 626 may be implemented as a form of time decay processing, where neural network cells (i.e., recurrent neural network architecture 620) have a local memory (i.e., state) and that memory is time-decayed prior to processing of a new data sample"
- para. 96: "The time-decay can be purely a function of the time"

iii) an update logic stage configured to: update the state data output from the decay logic stage using an input tensor generated from the data corresponding to the incoming transaction to generate updated state data; to store said updated state data in the memory for the entity and category identifier pair associated with the incoming transaction; and to output an output tensor comprising the updated state data (figure 6B, showing the inner working of the module 620 in particular the combinatory logic 534; para. 79: "Following modification via the forget gate 626, the modified state data is combined, via combinatory logic 634, with the transaction feature vector output by the transaction data input interface 618 to generate output data 630 for the

proposed transaction... The output data 630 also forms the output for the state output interface 624. The output of the state output interface 624 may then be cached in memory or otherwise stored until a next transaction.");

iv) wherein the machine learning system is configured to map the output tensor from the categorical history module to a scalar value (figure 6A - all modules above the module 620; in particular the multilayer perceptron 690 taking as input 694 the output from the module 620 and generating the value 602) *representative of a likelihood that the incoming transaction presents an anomaly within a sequence of actions* (para. 65: "The scalar output 602 represents a likelihood that the proposed transaction presents a behavioural anomaly,"); *and*

v) wherein the scalar value is used to determine whether to approve or decline the incoming transaction (para. 65: "The scalar output 602 may be used to complete an approval decision for the proposed transaction, e.g. as described with reference to FIGS. 5 A and 5B, may be used to decide whether to approve or decline the proposed transaction.").

1.1.1 The subject-matter of claim 1 is accordingly not new (Article 33(2) PCT).

1.1.2 Notwithstanding the above it is noted that, even if claim 1 is amended to specify that the entity is a buyer and the categories relate to different transaction aspects (e.g. different sellers with which the buyer performs transactions), this would not lead to an inventive step. Such a differentiation would relate to non-technical aspects which cannot, per se, support the presence of an inventive step (see the Guidelines for Search and Examination at the European Patent Office as PCT Authority G-VII, 5.2. and 5.4, further referring to the Guidelines for Examination in the EPO, G-VII, 5.2 and 5.4 - henceforth referred to as Guidelines). Indeed, what the entities and what the categories denote (or in other terms what the cognitive content thereof is) is of no technical consequence.

1.1.3 Further notwithstanding the above it is noted that, even claim 1 is amended to distinguish it form D1 by specifying that for each entity a separate set of states is maintained, one for each of multiple categories, this would still not lead to the presence of an inventive step. The motivation to maintain for one and the same entity (e.g. a buyer) a separate state for each category (e.g. a separate state for each seller with which the buyer performs transaction) is to account for the insight (see e.g. paragraph bridging description pages 4-5) that the entity's/ buyer's behaviour is different for each category/seller (e.g. the buyer might typically spend small amounts at seller A and large amounts at seller B). Such insights are of a non-technical nature and cannot contribute to the presence of

an inventive step but are rather to be considered non-technical requirements that the skilled person is presented with and asked to implement (see Guidelines G-VII.5.4). The implementation of such insight when starting from D1 would however straightforwardly lead the skilled person to the claimed subject-matter as the skilled person would readily use different states for the different categories/sellers.

1.1.4 Finally and most importantly, it is noted that the overall purpose of claim 1 (and of the application as a whole) -identifying potentially fraudulent transactions- is not technical. The proposed models to be used thereby (in particular consisting of a certain combination of certain neural networks) is, *per se*, an abstract mathematical model/method (see Guidelines G-II 3.3. and 3.3.1). A mathematical method may contribute to the technical character of an invention, i.e. contribute to producing a technical effect that serves a technical purpose, by its application to a field of technology and/or by being adapted to a specific technical implementation. Neither appears to be the case in the present application. As indicated above, no technical purpose is present. Furthermore, the model as proposed does not appear to be adapted to any specific technical implementation.

1.2 The subject-matter of claim 21 reiterates the subject-matter of claim 1 in terms of a method and is accordingly, *mutatis mutandis*, not new (Article 33(2) PCT).

1.3 The subject-matter of claim 28 reiterates the subject-matter of claim 1 in terms of the module and is accordingly, *mutatis mutandis*, not new (Article 33(2) PCT).

1.4 The subject-matter of claim 29 is broader than the subject-matter of claim 21 (by leaving out the last two steps of the method of claim 21) and is accordingly, *mutatis mutandis*, not new (Article 33(2) PCT).

1.5 The subject-matter of claim 30 reiterates the subject-matter of claims 21 and 29 in terms of a computer-readable medium and is accordingly, *mutatis mutandis*, not new (Article 33(2) PCT).

2 Dependent claims

2.1 Dependent claims 2-20 and 22-27do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect of novelty and/or inventive step.

2.2 The additional features of these claims are disclosed in D1:

- claims 3 and 22: figure 6A, multilayer perceptron 610
- claims 4 and 23: figure 6A, multilayer perceptron 690

- claim 5: figure 6B, combinatory logic 634
- claims 6-8 and 24-26: see explanations for claim 1 (note that claims 6-8 does not exclude that all stored states are related to a single entity)
- claim 12: see explanations for claim 1
- claims 13-14: para. 78 or 99
- claim 27: see explanations for claim 1 and para. 56

relate to non-technical aspects/insights and their straightforward implementation:

- claims 15-17: a user's behaviour is to some extent independent of categories (e.g. does not depend on the seller) and only depends on the past behaviour across all categories
- claims 18-20: see explanations in 1.1.2 and 1.1.3 above

and/or relate to straightforward implementation details:

- claim 2 - see e.g. D2, para. 37
- claims 9-11 - see e.g. D2, para. 96 (note that an LRU cache corresponds to a memory configuration as a stack, at the defined level of detail).

2.3 The subject-matter of claims 3-8, 12-14 and 22-27 is accordingly not new (Article 33(2) PCT).

2.4 The subject-matter of claims 2, 9-11 and 15-20 is accordingly not inventive (Article 33(3) PCT).