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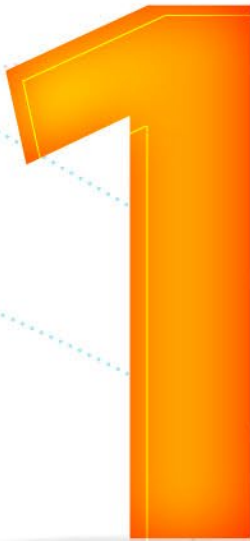# Some Principles for Successful Protection of AI

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Agenda

- Protecting your invention – many relevant IP rights
- Principles behind patenting
- Some specific considerations for patenting AI inventions
- EPO Boards of Appeal decisions relating to AI

1

Protecting your invention – many relevant IP rights

One product – many IP rights

Patents

- technical components (also with utility models)
- data processing methods
- details of operating system
- user interface functionalities
- applications

Trademarks

- company name
- name of product, application or service
- logo
- start-up tone or ringtone

Design rights

- overall design of product
- position and shape of display

Copyright

- software code
- user manual
- music
- images

Trade secrets

- technical solutions and know-how that can be kept secret
- cloud-based portion of data processing

Protect your property

Your invention is your property since you have invested time and money in making it

Is the invention worth protecting so that your competitor cannot collect the fruits of your labor?

Patents, designs and trademarks are investments

Patents, designs and trademarks are integral parts of corporate strategies of businesses:

- **protect the company against imitators**
- **increase the market share**
- **convince potential investors**
- **must avoid infringing competitors' patents and IP**
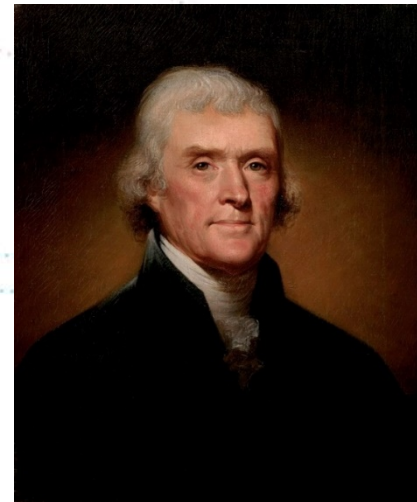- **use patent information in R&D**

2

Principles behind patenting

Patents

- A patent gives the owner the right to exclude others from using the invention professionally, not necessarily to use the invention
- This right to exclude others is given for a limited time in exchange for making the invention public
  - A patent application becomes public after 18 months, unless it is withdrawn
  - Society has two interests
    - *Promoting the development of new and useful technologies by incentivising inventors*
    - *Making information available to others*

Some background

- Venetian patent statute, 1474: Patents may be granted for "any new and ingenious device, not previously made", if also useful

- U.S. Constitution, Article I section 8, clause 8:[The Congress shall have power] "To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

- Thomas Jefferson, 1813: *"Considering the exclusive right to invention as given not of natural right, but for the benefit of society, I know well the difficulty of drawing a line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not."*

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Basic criteria for patenting

- European patent convention (EPC), 1973
- Four basic requirements from EPC Article 52: European patents shall be granted for **any inventions**, in all fields of technology, provided that they are **new**, involve an **inventive step** and are susceptible of **industrial application**. …
- Additional essential requirements:
  - Art. 83: The European patent application shall **disclose the invention** in a manner **sufficiently clear and complete for it to be carried out** by a person skilled in the art.
  - Art. 84: The **claims** shall define the matter for which protection is sought. They **shall be clear and concise and be supported by the description**.
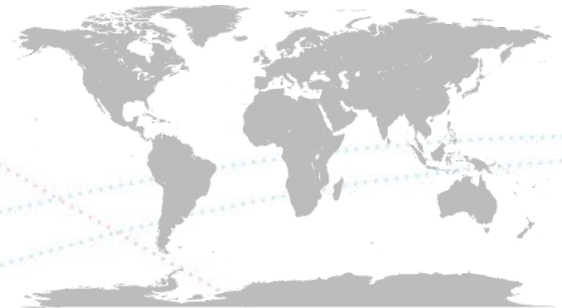
Inventive step

- EPC Art. 56: An invention shall be considered as involving an inventive step if, having regard to the state of the art, it is not obvious to a person skilled in the art.
- Problem-solution approach (PSA) is used in Europe (EPO GL G-VIII, 5) for determining inventive step
  - KSR rationales and Graham inquiries are used in the US for determining non-obviousness
  - China's three step procedure (GL for examination 4.3.2.1.1) corresponds to the problem-solution approach
- According to the EPO Boards of Appeal, the correct application of the PSA method avoids "hindsight"
  - Even simple inventions can be patented if they provide a technical effect and are not obvious
  - However, after reading the patent application (or using the invention) most inventions may seem obvious
  - Was the solution obvious to those unfamiliar with it?

Problem-solution approach

- In the problem-solution approach, there are three main stages:
(i) determining the "closest prior art",
(ii) establishing the "objective technical problem" to be solved, and
(iii) considering whether or not the claimed invention, starting from the closest prior art and the objective technical problem, would have been obvious to the skilled person.

- There are other, much more detailed versions of the problem-solution approach
    - Technical problem should be obvious based on (only) the closest prior art and common general knowledge of the person skilled in the art

International patenting

- Prior (or state of the) art can be any published document anywhere in the world
  - Even by the inventors!
- There is no "global" patent or trademark
- A Finnish applicant can start with a Finnish patent application (in English) and continue abroad using the PCT system
  - Office action from PRH with search report within about 7 months
  - An international PCT application must be filed within the priority year
  - Decision to file in specific countries must be made after 30 or 31 months
  - Patent Prosecution Highway (PPH)

Remember

- A patent is worthless, if (your competitor knows that):
  - There is no chance that you will enforce it, or
  - There is no chance you will sell the patent to someone willing to enforce it in the courts
- However, by filing a patent application, you may still get useful information about the state of the art

3

Some specific considerations for patenting AI Inventions

AI and patents

- AI can be involved with patents and patenting in many ways
  - Inventing
    - *Sets of alternatives can already be automatically evaluated*
  - Drafting patent applications
    - *E.g. converting scientific articles into patent applications*
  - Searching for prior art
  - Assessing inventive step
  - Administering patent-related work

- But here we will mainly discuss how AI-related inventions can be patented
  - Examiners do not care whether AI was involved in making an individual invention
  - However, the person skilled in the art can (more and more) be a team of skilled people augmented by AI

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Patenting AI in Europe

- Two hurdle approach for computer-implemented inventions (CII)
  - 1) Technical character / technical purpose
    - *Input data should be technical (relate to a specific physical entity) and the purpose of the processing should be technical*
    - *Should be more than a mentally implemented process or a pen-and-paper mathematical algorithm*
  - 2) Inventive step over the prior art
    - *Cannot be based on non-technical features*
- Note: AI methods are mathematical algorithms
  - A neural network (e.g. MLP) is essentially a flexible mathematical model with a chosen number of input and output dimensions, chosen internal structure and an associated learning algorithm

Technical character

- EPC Article 52:

(1) European patents shall be granted for **any inventions**, in all fields of technology, provided that they are new, involve an inventive step and are susceptible of industrial application.

(2) The following in particular shall not be regarded as inventions within the meaning of paragraph 1:

(a) discoveries, scientific theories and **mathematical methods;**

(b) **aesthetic creations;**

(c) schemes, rules and methods for performing **mental acts**, playing games or doing **business**, and **programs for computers**;

(d) presentations of information.

(3): Paragraph 2 shall exclude the patentability… only to the extent to which a… patent application… relates to such subject-matter or activities **as such.**

- The subject matter in paragraph (2) is not technical as such, either.
    - Inventive step cannot be based on non-technical features.

Fictitious example

- Claim 1: Classifying data using low-level features.
  - Input data not specified
- Amended claim 1: Classifying medical images using low-level color and texture features using a neural network.
  - Could still be performed mentally

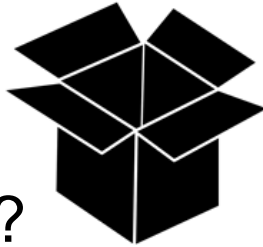Overcoming 1st hurdle

- Further amended claim 1:

A computer implemented method for training a deep convolutional neural network to classify images of skin lesions with a second set of training images obtained by augmenting a first set of training images by rotating said first set of images in colour space to include skin colour variations; and applying dropout function by randomly deactivating nodes in the deep convolutional network.

Possibly overcoming 2nd hurdle

Enabling disclosure, EPC Art. 83

- The authors may have a scientific publication with more disclosure
- Applicants often want to patent the basic outline of the algorithm
  - A black box algorithm: Input data -> "AI" -> solution?
  - Meta-level idea, typically not allowable.
- Algorithm must be disclosed so that a person skilled in the art would be able to implement it without undue burden
  - At least one detailed way of carrying out the claimed invention must be disclosed
  - The whole claimed scope must be enabled
  - The level of skill is similar in determining enablement and inventive step

Clarity of claims

- In order to compare the claimed invention to the prior art, the claims must be clear

- The claims must also actually provide the intended effect and solve the objective technical problem
  - Otherwise, the claims are unclear or at least essential features are missing
    - *And the objective problem must be reformulated*
  - Do not define the invention using individual features
    - *Make sure the input data and purpose of the processing are sufficiently defined*
    - *Make sure that the processing steps follow each other logically and that they depend on each other*
    - *Allowable claim breadth is up to the examiner*

New section in EPO GL on AI and ML

- **EPO Guidelines Nov. 2018: Part G-II, 3.3.1**
- Confirms that the same principles are used as for other mathematical methods
  - Mathematical methods are not patentable as such
    - *Terms such as "support vector machine", "reasoning engine", "neural network" are usually devoid of technical character*
  - Claimed invention must involve technical purpose
    - ***YES***: *Heart-rate monitoring; classification of images, video or audio based on low-level features (cf. T 1148/05)*
    - ***NO***: *Classifying text documents (T 1358/09); classifying "telecommunication data records" (T 1784/06)*
- Sufficiency of disclosure is often an issue in AI applications and related EPO BoA decisions

Problem-solution approach for mixed inventions

It is legitimate to have a mixture of technical and non-technical features in a claim, but inventive step must only be based on features contributing to technical character. (cf. T 0641/00)

As explained in the Finnish "patent manual" (Patenttikäsikirja E.3.5.2):

1) Determine the features claimed which (together) have a technical effect;
2) Set aside any other features;
3) Determine the "closest prior art" (CPA);
4) Determine the differences between what is claimed and the CPA;
5) Determine the technical effect of those differences in the context of the claim as a whole (alias the "technical contribution");
6) Determine from that the "objective technical problem" to be solved
   - (non-technical claim features may be given in the problem definition); and
7) Decide whether the claimed invention, starting from the closest prior art and the objective technical problem, would have been obvious to the relevant "person skilled in the art."

(T 0641/00, "COMVIK"; T 0258/03, "HITACHI"; T 0154/04, "DUNS") See also EPO GL G-VII, 5.4

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Patenting AI in the U.S.

- Many principles are similar, but the concept of technicality is not used in the U.S.
  - Nor technical effect or technical problem
  - Different principles for assessing non-obviousness
- To be patent eligible, the invention must involve significantly more than an abstract idea
  - Not just an abstract idea implemented on a common computer and communication network
  - However, eligibility (35 U.S.C. § 101) is assessed separately from assessing novelty (§ 102) and non-obviousness (§ 103)
  - Thus, novelty and non-obviousness over a prior art solution can still be related to an abstract idea (i.e., abstract features)

4

EPO Boards of Appeal decisions relating to AI

T 1784/06 (Classification method) 1st aux. req. claim 1:

A **method of classifying telecommunications network event description records in a mediator system of a telecommunications network** by means of a computer program product, comprising

- receiving records containing several fields, the fields of which records contain values,

- reading the values contained in at least two specified fields from each received record, and

- classifying the received records using a classification structure containing conditions, the classification structure containing field-specific classification structures such that there is an own field-specific classification structure for each field according to the conditions of the classification structure,

 characterized by

- selecting field-specific classification structures corresponding to the specified fields, and

- for each record:

- searching from the selected classification structures a set of suitable classes for each of the specified fields, wherein the suitable classes correspond to the value read from the field,

- forming an intersection set of the sets of suitable classes, and

- selecting a class from the intersection set and classifying the record into the selected class.

T 1784/06 (Cont.)

- Classifying telecommunications network event records
- Reasons for the decision:
  - 2.3 "…where an intrinsically non-technical solution (mathematical algorithm) seeks to derive a technical character from the problem solved, **the problem must be technical**."
  - 3.1.1 "…a technical character of the algorithm could be recognised only if it served a technical purpose… **claim 1 serves only the purpose of classifying the data records, without implying any technical use of the classification.** The claim covers any non-technical (e.g. administrative or commercial) use of the classified data records. In the light of the description, the classification method prepares rating and billing procedures."
  - 5 "…that data records are assembled from network events [in 1st aux req.] **may imply technical aspects** but does not alter the finding that the claimed method classifies the data records for the sake of classifying rather than for any technical purpose…"

T 1358/09 (Classification) Claim 1:

A method for the **computerized classification of an unclassified text document into one of a plurality of predefined classes** based on a classification model obtained from the classification of a plurality of preclassified text documents which respectively have been classified as belonging to one of said plurality of classes, said document and said documents respectively comprising a plurality of terms which respectively comprise one or more symbols of a finite set of symbols;

a) wherein said method involves the computerized building of said **classification model, comprising the following method steps:**

a1) representing each of said plurality of text documents, which are digitally represented in a computer, by a vector of n dimensions, said n dimensions forming a vector space, whereas the value of each dimension of said vector corresponds to the frequency of occurrence of a certain term in the document corresponding to said vector, so that said n dimensions span up a vector space;

a2) representing the classification of said already classified documents into classes by separating said vector space into a plurality of subspaces by calculating one or more hyperplanes, such that each subspace comprises one or more documents as represented by their corresponding vectors in said vector space, so that said each subspace corresponds to a respective class;

a3) calculating a maximum margin surrounding said hyperplanes in said vector space such that said margin contains none of the vectors contained in the subspaces corresponding to said classification classes;

b) wherein said method further involves, on basis of said classification model, the computerized classification of said unclassified text document as belonging to one of said plurality of classes, comprising the **following method steps:**

b1) representing said text document, which is digitally represented in a computer, by a vector of n dimensions, said n dimensions spanning up said vector space, whereas the value of each dimension of said vector corresponds to the frequency of occurrence of a certain term in the document corresponding to said vector;

b2) classifying said document into one of said plurality of classes by determining into which of said plurality of subspaces of said vector space said vector falls and identifying said document as belonging to a certain class which corresponds to the subspace into which said vector falls;

b3) calculating a confidence level for the classification of said document as belonging to said certain class based on the distances between the vector representing said document and all hyperplanes surrounding said subspace which corresponds to said certain class normalized by the corresponding margins such that a document which lies outside said margins is assigned a confidence level of '1' and a document which falls into said margins is assigned a value between '0' and '1'.

T 1358/09 (Cont.)

- Classification of a text document
- Reasons for the decision:
    - 5.2 "Classification of text documents is certainly useful, as it may help to locate text documents with a relevant cognitive content, but in the Board's view it does not qualify as a technical purpose."
    - 5.4 "The Board agrees that a human being would not apply the claimed classification method to perform the task of classifying text documents. …method may be faster than classification methods known from the prior art." 5.6 "The Board does not contest that the claimed classification method may provide reliable and objective results..."
    - 5.7 "**Since the mathematical algorithm does not contribute to the technical character… an inventive step can be present only in its technical implementation.** […] The Board further considers that the skilled person… would have had no difficulty in implementing on a computer the various steps of claim 1. The appellant never argued otherwise, which is consistent with the fact that the description of the present application does not provide any technical implementation details at all."

Art. 56 w.r.t. Art. 83 ➡️

    - 5.8 "…claim 1 lacks an inventive step…"

T 1148/05 (Image Classification) Claim 1:

Content-based image classification method for classifying digital images into the following classes: photographs, texts, and graphics; the method comprising:

- constructing a tree classifier from a set of training images each belonging to one of the classes involved in the classification, by using the Cart methodology and a set of low-level features describing the semantic content of images in the classes involved in the classification, said low-level features being quantities obtainable from the images by means of logico-mathematical expressions that are known beforehand, and

- classifying digital images in the classes involved in the classification by using said tree classifier;

wherein **said set of low-level features includes the following low-level features**:

a) the colour histogram in the 64-colour quantized HSV colour space;

b) the colour coherence vectors in the 64-colour quantized HSV colour space;

c) the 11-colour quantized colour transition histogram in the HSV colour space;

d) the moments of inertia of colour distribution in the non-quantized HSV colour space;

e) the moments of inertia and the kurtosis of the luminance of the image;

f) the percentage of non-coloured pixels in the image;

g) the number of colours of the image in the 64-colour quantized HSV colour space;

h) the statistical information on the edges of the image extracted by means of Canny's algorithm; in particular:

h1) the percentage of low, medium and high contrast edge pixels in the image;

h2) the parametric thresholds on the gradient strength corresponding to medium and high-contrast edges;

h3) the number of connected regions identified by closed high-contrast contours; and

h4) the percentage of medium-contrast edge pixels connected to high-contrast edges;

i) the histogram of the directions of the edges extracted by means of the Canny's edge detector;

j) the mean value and the variance of the absolute values of the coefficients of the subimages of the first three levels of the multi-resolution Daubechies wavelet transform of the luminance of the image;

k) the estimation of the texture characteristics of the image based on the neighbourhood grey-tone difference matrix (NGTDM), in particular coarseness, contrast, busyness, complexity, and strength;

l) the spatial-chromatic histogram of the colour regions identified by means of the 11-colour quantization process in the HSV colour space, and

in particular:

l1) the co-ordinates of the centroid of the colours; and

l2) the dispersion of the colour regions with respect to their centroids;

m) the spatial composition of the colour regions identified by means of the 11-colour quantization process, and in particular:

ml) fragmentation;

m2) distribution of the colour regions with respect to the centre of the image; and

m3) distribution of the colour regions with respect to the x-axis and with respect to the y-axis.

T 1148/05 (Cont.)

- classifying digital images into photos, text and graphics
- Reasons for the decision:
  - 4.2 "…term "digital images" may imply digital processing of the features expressing image properties and of the vectors representing image classes, and **all features are assumed to contribute to the technical character**…"
  - 5.2 "…the claimed method derives novelty from the use of a large library of 22 specific technical image parameters…"
  - 5.3.4 "…all the image features which are known to describe properties of digital images are natural candidates for distinguishing images, and classes of images… The application itself presents most of its low-level features as forming part of the prior art (A1, paragraph 0015). Regarding the few features for which no prior art has been cited in the application, the application still conveys the impression that those features represent usual parameters for describing and analysing digital images. Otherwise, if they were fundamentally new to the image processing person, they would have to be disclosed in much greater detail."
  - 5.4 "…claim 1 does not involve an inventive step…"

Art. 56 w.r.t. Art. 83

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T 0521/95

- Pattern recognition system with four associative units
- Decision given (10.3.2000) before Comvik (T 0641/00)

- Reasons for the decision:
  - 4.1 "…the Board considers that a necessary requirement for sufficiency is that there is **at least disclosed one embodiment** which can be carried out."
  - 4.4 "It is well known in this field that the hardware is only a part of the invention which cannot do anything without the appropriate weighting coefficients. The situation is comparable to a computer which is not provided with appropriate software."
  - 4.6 "…it must be examined whether the application gives enough information for the skilled person to derive the coefficients based on common general knowledge in the art."
  - 4.8 "Finding the correct training scheme is a critical part of the design of the system and not a matter of chance. Apart from the reference to Hebb… the description does not even mention this matter, let alone give any guidance…"
  - 4.9 "…the board judges that the skilled person could not train the whole system to solve the specific problems given in the application **without undue burden**" (EPC Art. 83)

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Summary

- Include a detailed description of at least one way of carrying out the invention

- Define the input to the algorithm and the purpose of the processing

- Use a patent agent in drafting the application and claims