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- Opinions and Counseling

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• Sharing of ideas (e.g., new legal and practical developments)

Result: value for money for our clients
Questions?

vlad.teplitskiy@knobbe.com
DIGITAL PATENTS AT THE EPO: TRENDS AND CHALLENGES

Silvia Dondi – European Patent Attorney
AGENDA

• legal framework
• Machine Learning (ML) and Artificial Intelligence (AI): are they mathematical methods?
• examination methodology for mixed-type inventions: two-hurdles approach
• a selection of practical examples
• fresh news from the EPO: patentability of computer-implemented simulations (G1/19)
LEGAL FRAMEWORK - EPC

➢ European patents shall be granted for any invention, in all fields of technology, provided they are new, inventive and have industrial application.

NON-INVENTIONS

a) discoveries, scientific theories, mathematical methods
b) aestethic creations
c) schemes, rules and methods for performing mental acts, playing games or doing business, and programs for computers
d) presentations of information
# TECHNICALITY BORDER

<table>
<thead>
<tr>
<th>Claimed subject-matter</th>
<th>as such - excluded</th>
<th>not as such - not excluded</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a)</td>
<td>discoveries, mathematics</td>
<td>technical application</td>
</tr>
<tr>
<td>(b)</td>
<td>aesthetics creations</td>
<td>concrete substrate</td>
</tr>
<tr>
<td>(c)</td>
<td>mental acts, games, business</td>
<td>computer implemention</td>
</tr>
<tr>
<td>(c')</td>
<td>computer programs</td>
<td>further technical effect</td>
</tr>
<tr>
<td>(d)</td>
<td>presentation of information</td>
<td>physiological effect</td>
</tr>
<tr>
<td>(d')</td>
<td>data structures</td>
<td>human-machine interaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>functional data</td>
</tr>
</tbody>
</table>

non-technical domain ↔ technical domain
AI / ML: BORDERLINE?

- **AI** → computational systems capable of performing tasks that typically require human intelligence
- **ML** → systems that can **learn from data** for predicting future data or output of interest
- **ML** involves **maths**
# AI TERMINOLOGY

<table>
<thead>
<tr>
<th>Term or expression</th>
<th>Meaning?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Support vector machine</td>
<td>Abstract classifier or hardware or software (machine)</td>
</tr>
<tr>
<td>Reasoning engine</td>
<td>Abstract algorithm or hardware or software engine</td>
</tr>
<tr>
<td>Neural network</td>
<td>Abstract model or implemented model</td>
</tr>
<tr>
<td>Computational node</td>
<td>Conceptual entity or hardware node</td>
</tr>
<tr>
<td>Synaptic connection</td>
<td>Logical connection or hardware connection</td>
</tr>
<tr>
<td>Using AI, using machine intelligence</td>
<td>?</td>
</tr>
</tbody>
</table>
AVOID THE «BLACK BOX» FALLACY

➢ explain the «black box»
➢ establish a concrete link between ML and the real world
MIXED-TYPE INVENTIONS

claims comprising technical and non-technical features
TWO-HURDLES APPROACH

• 1st hurdle: eligibility as invention

• 2nd hurdle: patentability
  ➢ clarity
  ➢ novelty
  ➢ inventive step
1st HURDLE: is it an invention?

**non-technical domain**
- pure abstract computational models and algorithms
- may serve a technical purpose
- serves a **generic** technical purpose (classification, regression, clustering, dimensionality reduction)

**technical domain**
- involving the use of technical means
- adapted for a **specific** technical implementation or serving a **specific** technical purpose
- having technical application
- data / parameters of technical nature
EXAMPLE N. 1 – documents classification (T 1358/09)

➢ using ML for retrieval of documents in an archive

issue: extracting relevant information from a huge archive

solution: vectors based on terms for classifying the documents
EXAMPLE N. 1 – claim as filed

A method for building a classification model for classifying unclassified documents based on the classification of a plurality of documents which respectively have been classified as belonging to one of a plurality of classes, said documents being digitally represented in a computer, said documents respectively comprising a plurality of terms which respectively comprise one or more symbols of a finite set of symbols, and said method comprising the following steps:

• representing each of said plurality of documents 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;

• representing the classification of said already classified documents into classes by separating said vector space into a plurality of subspaces by one or more hyperplanes, such that each subspace comprises one or more documents as represented by their corresponding vectors is said vector space, so that said each subspace corresponds to a class.
EXAMPLE N. 1 – is it an invention?

• **generic** technical purpose: classifying text documents
• pure mental act
• **non-technical** problem: mere semantic
• terms are data of **non-technical** nature

1\textsuperscript{st} hurdle NOT PASSED!
EXAMPLE N. 2 – medical images classification

- using ML for recognising anomalous skin lesions

**issue**: limited amount of available samples in medical fields

**solution**: augmenting the number of samples
EXAMPLE N. 2 – claim as filed

A method for classifying images based on training a neural network with a second set of training images obtained by augmenting a first set of training images by means of rotating a first set of images in colour space to include skin colour variations.
EXAMPLE N. 2 – is it an invention?

- **generic** technical purpose: classifying images
- pure mental act
- non-technical problem (apparently)
- are images data of technical nature?

1st hurdle NOT PASSED!
EXAMPLE N. 2 – amended claim

A computer-implemented method for classifying images of skin lesions based on training a neural network with a second set of training images obtained by augmenting a first set of training images by means of rotating a first set of images in colour space to include skin colour variations.
EXAMPLE N. 2 – is it an invention now?

✓ computer is a technical means
✓ technical field: healthcare
✓ specific technical purpose: classifying skin lesions using a computer
✓ technical problem solved: recognising skin lesions
✓ skin images are data of technical nature

1st hurdle PASSED!
EXAMPLE N. 3 – heart monitoring (T 598/07)

➢ use of a neural network in heart monitoring for identifying irregular heartbeats

issue: false positive signals

solution: reliable distinction between normal and abnormal signals
EXAMPLE N. 3 – claim as filed

A heart monitoring method comprising the steps of:

• receiving *an electrocardiograph signal* from a patient during a monitoring phase,
• preprocessing the electrocardiograph signal to suppress the noise and to analyse the shape of each pulse of said electrocardiograph signal to obtain a plurality n of values representative of the shape of each pulse of said electrocardiograph signal,
• forming *an n dimensional vector* from said plurality n of values,
• comparing the n dimensional vector with a stored plurality m of n dimensional reference vectors defining *an n dimensional volume* to determine the proximity of the n dimensional vector to said reference vectors, and
• outputting *a signal* if it is determined that the n dimensional vector is within or beyond a threshold range of said n dimensional reference vectors.
EXAMPLE N. 3 – is it an invention?

✓ technical field: healthcare
✓ specific technical purpose: monitoring heartbeats
✓ technical problem solved: identify irregular heartbeats
✓ electric signals are data of technical nature

1st hurdle PASSED!
EXAMPLE N. 4 – assisting vehicle guidance
EXAMPLE N. 4 – claim as filed

A method of assisting vehicle guidance over terrain, the method including:

• training (306) at least one first classifier technique (308) using a first set of terrain classifier training data (304), such that the at least one first classifier technique is trained to output at least one probability value (314) usable to classify terrain;

• using the at least one first trained classifier technique (308) to generate a second set (312) of terrain classifier training data;

• training (320) a second classifier technique (322) using the output of the at least one first classifier technique for the second set (312) of terrain classifier training data, and additional data (318) including an image-based representation of the terrain of the second data set, such that the second classifier technique is trained to output a probability value (326) usable to classify terrain.
EXAMPLE N. 4 – is it an invention?

- **technical** field: automotive
- **specific technical** purpose: assisting vehicle guidance
- **technical** problem solved: predicting the behaviour of a vehicle on upcoming terrain
- terrain and vehicle parameters are data of **technical** nature

1st hurdle PASSED!
2nd HURDLE – is it inventive?

non-technical domain

technical domain

invention

CPA

obvious?
PROBLEM-AND-SOLUTION APPROACH

Modified for mixed-type inventions

- Identify technical features
  - Closest prior art
  - Distinguishing features
  - (Technical) effect
  - Objective technical problem
  - Inventive step?

The presence of an inventive step may only be supported by those features of the claim which provide a technical effect serving a technical purpose.
EXAMPLE N. 2 – examining inventive step

A computer-implemented method for classifying images of skin lesions based on training a neural network with a second set of training images obtained by augmenting a first set of training images by means of rotating a first set of images in colour space to include skin colour variations.

D1: neural network for detecting skin lesions
EXAMPLE N. 2 – further amendment

A computer-implemented method for training a deep convolutional neural network to classifying images of skin lesions based on training a neural network with a second set of training images obtained by augmenting a first set of training images by means of rotating a first set of images in colour space to include skin colour variations; and applying dropout function by randomly de-activating nodes in the deep convolutional neural network.
EXAMPLE N. 2 – is it inventive?

- D1: neural network for detecting skin lesions by ML
- technical differences: deep convolutional neural network + dropout technique
- technical effect: more appropriate classification of skin lesions over D1

2\textsuperscript{nd} hurdle PASSED!
EXAMPLE N. 4 – examining inventive step

A method of assisting vehicle guidance over terrain, the method including:

- training (306) at least one first classifier technique (308) using a first set of terrain classifier training data (304), such that the at least one first classifier technique is trained to output at least one probability value (314) usable to classify terrain;
- using the at least one first trained classifier technique (308) to generate a second set (312) of terrain classifier training data;
- training (320) a second classifier technique (322) using the output of the at least one first classifier technique for the second set (312) of terrain classifier training data, and additional data (318) including an image-based representation of the terrain of the second data set, such that the second classifier technique is trained to output a probability value (326) usable to classify terrain.
EXAMPLE N. 4 – the method

Fig. 3

TRAINING NEAR-FIELD CLASSIFIER

TRAINING NOW-FIELD CLASSIFIER
EXAMPLE N. 4 – opinion in Chapter I

- NOT clear (same wording for different features, inconsistencies)
- NOT novel in view of prior art
- **dependent claim 5 considered inventive**

the second classifier technique comprises

_a Regression Model technique_
EXAMPLE N. 4 – amended claim

A method of assisting vehicle guidance over terrain, the method including:

• training (306) at least one first classifier technique (308) using a first set of terrain classifier training data (304), such that the at least one first classifier technique is trained to output at least one probability value (314) usable to classify terrain;

• obtaining a second set (312) of terrain classifier training data and using the at least one first trained classifier technique (308) to generate an output second set (312) of terrain classifier training data;

• training (320) a second classifier technique (322) using the said output of the at least one first classifier technique for the second set (312) for the second set of terrain classifier training data, and additional data (318) including an image-based representation of the terrain of the second data set, such that the second classifier technique is trained to output a probability value (326) usable to classify terrain, characterised in that the second classifier technique comprises a Regression Model technique (320).
EXAMPLE N. 4 – EPO’s official action

- NOT clear

  - **technical difference**: the second classifier technique comprises a regression model technique
  - **technical effect**: linking the results of the 1\textsuperscript{st} classifier with the results of the 2\textsuperscript{nd} classifier
  - **conclusions**: regression technique to correlate different experimental datasets is well-known to the skilled person and constitutes one of several solutions the skilled person would select in order to establish correlation between datasets.

2\textsuperscript{nd} hurdle NOT PASSED!
EXAMPLE N. 4 – granted claim

A method of assisting vehicle guidance over terrain, the method including:

• training (306) at least **one first classifier** technique (308) using **a first set of terrain classifier training data** (304) representative of a Now field of the vehicle, such that the at least one first classifier technique is trained to output at least one probability value (314) usable to classify terrain;

• obtaining **a second set (312) of terrain classifier training data** comprising image data (316) captured from a Near field of the vehicle and data (310) indicative of vehicle state characteristics sensed when the vehicle passes over terrain represented in the image data (316) captured from the Near field;

• using the at least one **trained first trained classifier technique** (308) to generate **an output** comprising at least one probability value usable to classify terrain using the data indicative of vehicle state characteristics in the second set of training data; and

• using **a Regression Model technique** (320) to associate training (320) a second classifier technique (322) using said output of the at least one trained first classifier technique for using the second set (312) of terrain classifier training data, and with additional data (318) including an image-based representation of the terrain of data derived from the image data in the second data set of training data such that thereby to train **a second classifier technique** (322) is trained to output a probability value (326) usable to classify terrain represented in image data captured in a Near field of the vehicle, characterised in that the second classifier technique comprises a Regression Model technique (320).
EXAMPLE N. 4 – applicant’s arguments

Claim 1 and Claim 14 now include the intermediate step of using a regression model technique to relate features extracted from a training data set that includes image data in a Near field of the vehicle with terrain types recognised by a terrain classifier trained on Now field training data when presented with training data comprising vehicle characteristics sensed when the vehicle passes over the terrain imaged in the Near field image data of the training data set as a basis for training a second terrain classifier. This has the advantage that a much larger training data set may be generated for training the second classifier than is possible with prior art techniques.

2nd hurdle PASSED!
PRACTICAL TIPS (I)

• provide technical context / application
• consider to state a specific technical purpose (vs. generic purpose)
• provide technical features contributing to the technical solution
• include components of the «black box»
• provide concrete link between ML and real world (vs. pure mental act)
• provide basis for arguing technical effects already at filing
• focus on human-machine interaction process (vs. fixed scenario)
PRACTICAL TIPS (II)

• in general: draft more claims in the same category
• specifically: draft more method claims (classifying, training, etc.)
• use claim categories in view of the distributed character of the invention
COMPUTER-IMPLEMENTED SIMULATION

EP 1546948A2

- a method of simulating the movement of a pedestrian crowd through a building such as a railway station or stadium
- the simulated movement may be used to design the building
- the simulation provides an accurate and realistic model of how real-world crowds move in a building → improves the building design process
THE REFERRAL

- **Examining Division**: lack of inventive step
- **Board of Appeal**: a technical effect requires a direct link with physical reality that a simulation method does not have
- **Referral to the Enlarged Board of Appeal** ([G1/19](#))
- **Oral Hearing** on July 15, 2020 open to public
G1/19: THE QUESTIONS

1) In the assessment of inventive step, can the computer-implemented simulation of a technical system or process solve a technical problem by producing a technical effect which goes beyond the simulation's implementation on a computer, if the computer-implemented simulation is claimed as such?

2) If the answer to the first question is yes, what are the relevant criteria for assessing whether a computer-implemented simulation claimed as such solves a technical problem? In particular, is it a sufficient condition that the simulation is based, at least in part, on technical principles underlying the simulated system or process?

3) What are the answers to the first and second questions if the computer-implemented simulation is claimed as part of a design process, in particular for verifying a design?
G1/19: OUR ANALYSIS

1) Can simulation methods implemented on a computer provide a technical effect that goes beyond the basic technical effect produced by the electrical currents circulating inside the computer?

2) If the Computer-Implemented simulations can be patented, which are the criteria for the presence of inventive step (which is the technical effect they shall produce to have inventive step)?

3) If a Computer-implemented simulation is claimed as part of some larger process (a process for designing a building), to what extent does the simulation contribute to the inventive step? Do we need more on the “design” side or are the simulation features sufficient for the inventive step?
THANK YOU!

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- European and Italian Patent and Design Attorney
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- Working in Bugnion since 2008 and partner since 2017
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• Aerospace Engineer, graduated at the Polytechnic University of Milan

• European and Italian Patent, Trademark and Design Attorney

• Managing Partner of Verona Office and Member of the Bugnion’s Board of Directors

• 20-years experience in I.P. prosecution, counseling, opinions and litigation support

• Expert in aerospace, mechanical, medical equipment and devices, packaging machines, locking systems, computer software

• Hundreds of patent applications drafted and prosecuted, both before the Italian PTO and the EPO
Sandro Sandri

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• European and Italian Patent, Trademark and Design Attorney

• 40-years experience in I.P.:
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