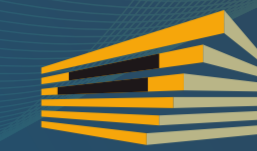# OT-38

Method and system for handwritten text generation with different maturity levels of the writer

TYPE OF R+D RESULT

- New technology
- New product
- New service
- **New knowledge or skill**

COMMERCIAL MATURITY LEVEL

- Model or conceptual idea
- Proof of concept (design)
- **Validated in a controlled environment**
- Validated in a real environment
- Successfully implanted

PROTECTION LEVEL

- Non- applicable
- **Patent**
- Software
- Know - how
- Utility model

Invention title	Method and system for handwritten text generation with different maturity levels of the writer
File number	US10,977,422; ES2610794B2
Priority date	06/17/2016
Status	Granted / Published
Country	United States of America and Spain

Description of the solution. Problem solved

The present system allows to generate synthetic texts similar to those generated by real writers with different levels of learning or neurology and motor skills. This way, it enables the simulation of the learning time processes of the writer.

This system, that can be implemented in software, hardware or in both, does not require an original text to synthesise another one that emulates real writers with different learning levels or neurological and motor skills; it is protected by the following patents ES201600539 and US10977.422.
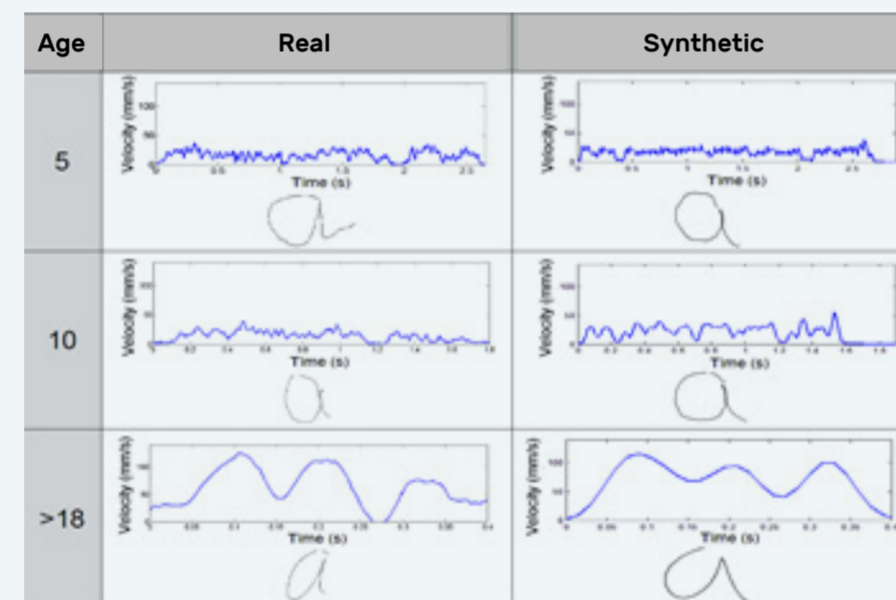
Although there are some methods that are intended to solve the technical problem of generating synthetic written text, they face the following disadvantages:

- They are based in processing the image of the handwritten text, increasing thus the processing time.
- They do not simulate learning and variability obtained with practise, neither provide the position of the pencil with its temporal reference.

The present method solves technical challenges synthesising text similarly to real ones; simulating its evolution both in number of strokes, as in the velocity profile of the writer according to its progress; and giving the opportunity to modify parameters that can be related to neurological patterns or human learning engines in a simple way.

The procedure is done in several stages:

- Stage 1: the trajectory of each letter is selected basing on a previously stored trajectory. This process is done only once in the moment where the type of writing or language that is going to be learnt is programmed.
- Stage 2: in this stage the evolution method is applied by selecting a series of points depending on the age of the writer.
- Stage 3: in this stage the different letters are connected by joining together upper and lower lines of the grid.

A vector is two consecutive points of the grid. The system calculates the angle between two consecutive vectors, using a series of parameters that model the velocity profile.

Additionally, a constant is associated to each writer. This constant depends on the motor features and, therefore, is different for each individual. With the effect of passing of time, this constant may evolve.

In order to synthesise learning difficulties or neurological problems of the individual, several parameters are modified and they may be adjusted to the type of disease (Parkinson, amyotrophic lateral sclerosis, Alzheimer, etc.).

Fields of commercial application

The natural field of application of this system for synthesising texts is confined to the generation of unlimited databases for biometric training; that means, it is intended for identifying people according to the recognition of a physical and non-transferable feature: handwriting.

However, besides the original purpose of this invention, this system may be used in areas as diverse as the following: pedagogy, education, OCR (Optical Character Recognition), software security by CAPTCHA (Completely Automated Public Turing Test to tell Computers and Humans Apart), text digitalisation, neurology or neurodegenerative diseases diagnosis.

Market opportunity

Research on handwritten texts synthesising is used in different fields. The first approach was intended to provide a major database of biometric handwriting for assessing the automated signature verification tools or automated writer verification and avoid legal issues around privacy.

The inclusion in a handwriting synthesiser of intra- and interpersonal variability, as well as health variability due to different diseases such as Parkinson or Alzheimer may help to understand all the underlying processes of human handwriting production.

These systems may also be useful for artistic creation, more precisely for authorship identification or generation of security CAPTCHAs.

The system has been validated comparing the synthesised text with real data from children and adults. Only in education sector, in particular in pedagogy field, there are already developments for including this system in commercial platforms for teaching (GetWriting®.)

Competitive advantage

Current existing methods fail to solve the problem of generating written texts that simulate the evolution associated to the different levels of maturity of the writer. In addition to this, such methods do not allow to simulate, by a minimum number of parameters, both the positions of the writing tools (pen or pencil) over time or the learning time of the writer.

Compared to other alternative solutions, this system allows the following:

- Optical Character Recognition (OCR) of handwritten text, improving the digitisation of such texts.

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- Adding new security layers when generating CAPTCHAs, increasing the reading complexity for robots in order to distinguish human users from computers.
- Improving writer identification.
- Tracking progress of children who are learning to write.
- Improving monitoring and screening of neurodegenerative diseases.
- Improving the detection of disorders in the ability to write (dysgraphia).