

## Interactive art therapy based on sketch by using GAN

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### Abstract

This paper proposed a system based on art therapy for visualizing internal emotion state of the patients which suffer mental illness, like elders with Alzheimer's disease, depressed students and autistic children. The system works by that the patients are asked to draw a sketch, then the sketch was further fully connected and colorized automatically by the system based on a deep learning technique, called Generative adversarial networks (GAN), during the colorization, the color which system use is based on patients' emotional parameters, like anger, depressed, upset, then the more beautiful image will be outputted to make the interaction with patients and gets them healed.

### Introduction

Nowadays, many people are under deep mental stress, just like, children have to attend many tutoring classes after finishing the school lessons, teenagers have to struggle in the work and fit themselves into the company, and what about the elders, their body becomes worse and ability of brain are also declining, it seems to be very hard for them to get a high level of health in such a tough period.

This phenomenon also confused some psychologists and therapists, those patients are less willing to talk and resist to get healed, deny their situations of illness. Then the therapists get another method to fit these patients which are not willing to talk and interactive with doctors, that is Art Therapy, which its theory is first founded by "the father of art therapy" Edward Adamson in the British [1], and the process of art therapy is the transference process between the therapist and the client who makes art. The therapist interprets the client's symbolic self-expression as communicated in the art and elicits interpretations from the client [2]. And the art doesn't mean only the pictures, also contain dance, singing, and so on [3]. Which we pay attention on is the drawing.

We proposed a new type of the art therapy by using AI. The patients are requested to draw a sketch which can represent their current inner situation, then we use AI to make the transform from the sketch to the art, of course, make it more beautiful and colorful then will output an art which is the very upgraded version of the sketch which patients draw in the beginning. The next step is the therapy, the previous steps is for creating a better art then the next is to make the patients feel better, that is the point "healing".

About the therapy, we show the art to them, and make the record of their facial emotion for helping us to get the feedback of the experiment, whether they become better or not. But just showing the art maybe not good enough to achieve the goal "therapy". Then we get a more efficient way to heal them.

### Backgrounds

As the original goal for producing the art therapy is for healing the mental illness, like Alzheimer's disease in elders, depressed students and autistic children, but nowadays not only the elder and the children, even the teenagers and the much younger students are also in the deep stressed situation. Zahra et al [4] measured a quantity of refugee children's inner situation with the art therapy and also healed them. The method they use can be divided into five steps: (1) giving voice; (2) rebuilding trust, opening wounds; (3) sharing stories, healing pain; (4) exploring identity, discovering new-self; and (5) understanding art therapy. Thus therapists are very good at getting them healed, but the AI can be used everywhere and any time without retirement.

Martin et al [5] proposed a system which is a robot can be used for the art therapy, the robot can draw pictures together with the patients and make the interaction with the patients to make them happy and feel better. But the problem is that the patients maybe not willing to pay a high price for the robot only for the therapy. And the evaluation is also a difficulty to overcome.

As for the evaluation, Rosalind et al [6] used Hopkins Symptoms Checklist-25 (HSCL-25) and the Strengths and Difficulties Questionnaire (SDQ) to assess the well-being. Marie et al [7] use Visual Analog Scales (VAS) to evaluate the inner changes (stress, depression, anxiety, pain and the other negative emotion) of 50 cancer patients after receiving chemotherapy. The majority of previous works use questionnaire to make the measurement, but the healing process won't be revealed by using the questionnaire. So we are trying to get a new way to make the evaluation.

From the previous work, there are less research about the AI using in the art therapy domain, thus nowadays AI are becoming more and more powerful, and the Deep-Learning techniques are fashion too, so we get an idea that we can use the Deep-Learning techniques to build a simple AI to make a contribution in the art therapy

### Method

We proposed a system that can make the translation from sketch to the wonderful image and make the patients better. As showed in the flowchart below (Figure1).

By using the Deep-Learning technique which called Generative adversarial networks (GAN), which is a class of machine learning systems invented by Ian Goodfellow and his colleagues in 2014 [8]. Two neural networks contest with each other in a game (in the sense of game theory, often but not always in the form of a zero-sum game). Given a training set, this technique learns to generate new data with the same statistics as the training set. These days, GAN are often used to generate an image or

making the colorization. Then for the facial recognition we use the opensource application called Affectiva. And this tool can help us to analyze the patients` emotion and using a number of parameters to make the evaluation of their facial expression.

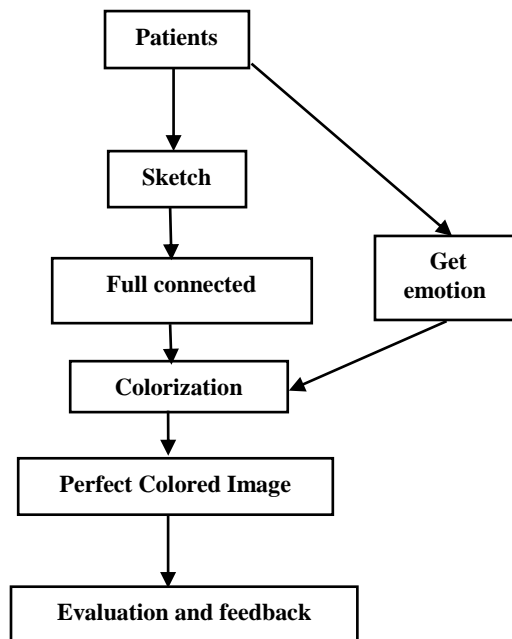


Figure1: Flowchart of the proposed system

Firstly, let the patients draw a sketch which can make the representation of their current inner situation, may be a boy, house or river, all is ok. Patients may be not good at drawing, so it will be necessary to make it full connected and make the line much more beautiful.

At the same time, by using the facial recognition techniques to get the patients` emotion before the experiment then we can get the situation of the patients, like angry, depressed, upset...Then it's the highlight: colorization, when getting the feeling of the patients which showed on their faces, the AI will know which color to use, by using the psychological color theory, like red to cheer them up, and so on.

Finally, we get the perfect colored image, which is fully connected and painted by the color which can heal them. Then showing this to the patients, and make the record of the change of the patients` emotion then we could get the facial emotion of patients after they watched the image. At last, it is important to make the measurement of the efficiency and to check whether it works or not.

### Results

For making a better evaluation, it will be necessary to make a record of the patients` facial emotion, from the results, before the experiments, patients don`t feel better, often showed angry, depressed, cold face, or no-emotion when finishing the experiments, the majority of patients are getting better, also have a happy face.

Then from the questionnaire, the results which filled by the experimental subjects also show the positive influence in the patients. And in the future work, we will make the system much better and improve the quality of the current work.

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