Prolonged Exposure Therapy(PE) AI

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Summary

- The quality and quantity of individuals' social relationships have been linked not only to mental health but also to both morbidity and mortality.
- Impaired social relationships are linked with Post Traumatic Stress Disable (PTSD).
- There is sufficient evidence to conclude the efficacy of exposure therapies in the treatment of PTSD[1].
- Generally, the treatment cost of PE is so expensive that such treatment is not accessible to people with low income. On the other hand, PE AI provides treatment assistance and eventually automate the therapy process, which is a low cost and relatively effective treatment.
- This poster proposes PE AI to generate scenes, situations, people or objects corresponding to the traumas that cause distress, provide contents for exposure therapies by using conditional GANs, assist imaginal exposure and in vivo exposure, the two main PE therapy components.
- PE AI will eventually be a psychological counselor with generated face, voice and mindset to give treatments from screens or robots.
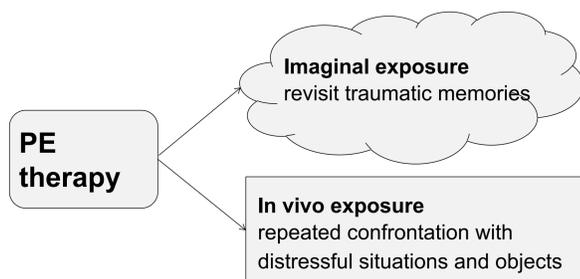
Motivation

Holt-Lunstad et al. [2] reported that social connections – friends, family, neighbors or colleagues – improve our odds of survival by 50 percent.

The paper also mentioned that health risk of low social interaction is:
- Equivalent to smoking 15 cigarettes a day
- Equivalent to being an alcoholic
- More harmful than not exercising
- Twice as harmful as obesity

Since impaired social relationship has high risk to the mental health, PTSD sufferers are especially worrisome, and PE therapy is necessary for the treatment.

PE therapy
→ **Imaginal exposure** revisit traumatic memories
→ **In vivo exposure** repeated confrontation with distressful situations and objects

In the process, the exposures, especially in vivo exposure, need specific situations, scenes, objects and figures for the process. Finding those objects or reconstructing the scenes could be difficult and hard.

Low-income regions may not have enough psychological counselors, and the cost is high, so the treatments may not be available to low-income people. But those people happen to be especially easily exposed to people and situations causing interpersonal traumas (e.g., rape, assault, child abuse, combat, etc.), and the kind of traumas are most likely help develop PTSD. Providing care to those people is very important.

"This whole chatbot therapy area is very promising, but there's still much research to be done!"   --- Andrew Ng

There are already some working therapy chatbots including Woebot. Unlike static figure sending messages, PE AI's expected functionality to generate contents, voice and real-time facial animation will make a difference from existing services.

Project Goals

The PE AI's goal is to provide assistance to psychological counselors giving prolonged exposure therapy, automate the process and give all of the PTSD sufferers health care. In details, PE AI will…
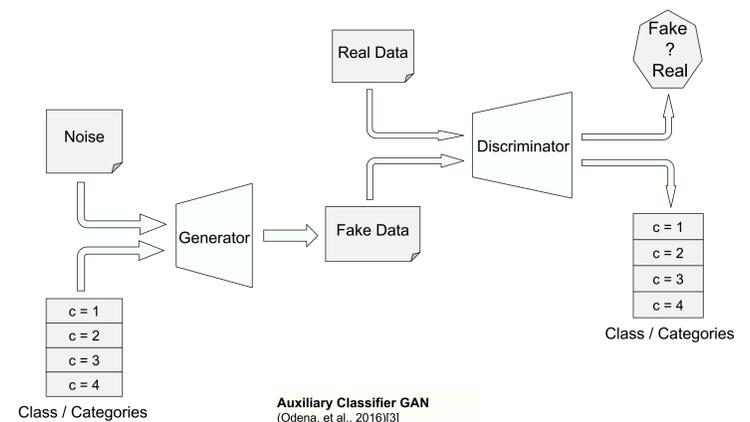- help human counselors
  - ✓ Generate scenes, objects, figures, faces for exposure therapies based on patient backgrounds and trauma descriptions.
- substitute for human counselors
  - ✓ Generate face, language, voice for the counselor robot
  - ✓ Generate facial animation based on generated counseling language
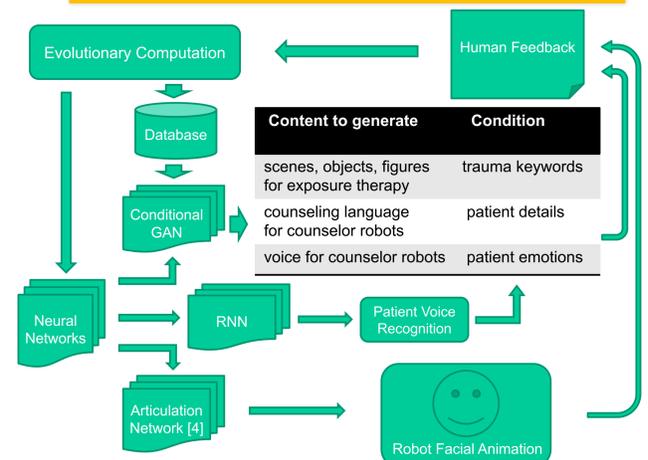
GAN: The basis for PE AI

Generative adversarial network (GAN) is a kind of neural network for content generations implemented by a system of two neural networks contesting with each other in a zero-sum game framework — a generator that learns to generate fake samples from an unknown distribution or noise and a discriminator that learns to distinguish fake from real samples.

The basic GAN framework can be augmented using side information.

In a **conditional GAN (CGAN)**, the generator learns to generate a fake sample with a specific condition or characteristics (such as a label associated with an image or more detailed tag).

Noise
Real Data
Generator
Fake Data
Discriminator
Fake ? Real
c = 1
c = 2
c = 3
c = 4
Class / Categories

Auxiliary Classifier GAN
(Odena, et al., 2016)[3]

PE AI's Framework

Evolutionary Computation
Human Feedback
Database
Conditional GAN
Neural Networks
RNN
Patient Voice Recognition
Articulation Network [4]
Robot Facial Animation

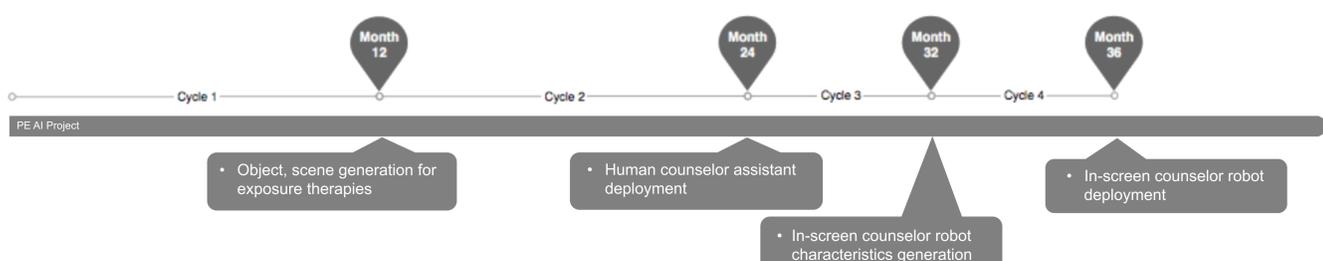| Content to generate	Condition
scenes, objects, figures for exposure therapy	trauma keywords
counseling language for counselor robots	patient details
voice for counselor robots	patient emotions

Goal Validation

Achievement of the project will be measured and evaluated by:
- Relevance between trauma keywords and the scenes and objects generated by the system
- System quality improvements from evolutionary computation during system deployments
- Realism and friendliness of the robot counselor felt by PTSD patients

It is expected that:
- Generated contents for PE therapies are relevant, distress patients effectively during exposure process
- Relevance of generated contents improves
- No uncanny, or strangely familiar, feelings of eeriness and revulsion in observers elicited from the counselor robots

Project Work Plan

Month 12
Month 24
Month 32
Month 36
Cycle 1
Cycle 2
Cycle 3
Cycle 4
PE AI Project
- Object, scene generation for exposure therapies
- Human counselor assistant deployment
- In-screen counselor robot characteristics generation
- In-screen counselor robot deployment

References

[1] Institute of Medicine's Committee on Treatment of Posttraumatic Stress Disorder "Treatment of PTSD: An Assessment of The Evidence" (2007)
[2] Holt-Lunstad J, Smith TB, Layton JB "Social Relationships and Mortality, Risk," A Meta-analytic Review (2010).
[3] Augustus Odena, Christopher Olah, Jonathon Shlens "Conditional Image, Synthesis With Auxiliary Classifier GANs," (2017).
[4] Tero Karras, Timo Aila, Samuli Laine, Antti Herva, Jaakko Lehtinen "Audio-driven facial animation by joint end-to-end learning of pose and emotion," (2017).