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REVIEW ARTICLE

EFFECTIVE DETECTION OF CANCER AND THERAPY

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ABSTRACT

To help make cancer a curable disease by identifying the cause of the cancer, discover better therapies and address the major challenges in curing cancer by developing innovative approaches like possibilities of applying Artificial Intelligence to come up with better remedies in tackling the current challenges in treating cancer, minimise the instances of cancer disease and hopefully make cancer curable disease. Thus, making an effective contribution to the society in the field of healthcare services to fight against cancer and save more lives.

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INTRODUCTION

Myinterest to find the cause and the cure of cancer began under the influence of personal and highly distressing circumstances. A friend was diagnosed with cancer and during myvisits to her in the hospital, Istarted wondering that although we have reached moon, created nuclear bomb, but stillhave not cure cancer? Why? This question haunts mewatching the sufferings and agony of cancer patient.Ibegan to realise that while many people suffer from this disease; the detection and cure is often difficult and complicated.Through the conversations with doctors and myresearch, Iunderstood that the cause and hence the cure, is different for different people due to profound genetic variation in cancer-causing mutation in the samecancer type in individual patient.The challenge for medical researchers is to identify which of these mutations are responsible for genetic fault that leads to specifictype of cancer.We soon began to ponder and brainstorm over the possibilities of applying Artificial Intelligence to come up with better remedies in tackling the current challenges in treating cancer, minimise the instances of cancer disease and hopefully make cancer curable disease one day.

Major Challenges in treating Cancer

- Lack of identification of cancer causing mutation.
- Drug resistance, as cancer causing mutation in tumours change with time and during treatment, targeted drugs that were previously effective may stop working.
- Difficulty in diagnosis in early stageas cancer may exhibit very little (or non-specific) symptoms until they are at an advanced stage.
- Misdiagnoses due to fatigue and tedious job of examining x-rays to identify the potentially malignant tumour from benign one.
- Limited identified early markers/symptoms in case of metastatic cancer.
- Limitations of conventional chemotherapeutic agents as it is toxic to all cells including cancer and normal cell.

Idea to address the major challenges in treating cancer

A cognitive system that can be developed and trained through deep learning technique, using datasets of past cancer patient, to spot a pattern that can point to cancer and hence diagnose potential cancer. Deep learning technique involves the usage of deep neural networks that learn tasks on their own by analysing vast amounts of the dataset and able to teach themselves new ways of spotting danger signs. These datasets used to train algorithm can contain information related to past cancer patient like medical (e.g. GP presentation patterns, medical history, prescription records, health insurance claims, x-rays, ultrasound) or non-medical (e.g. social media activity, shopping history, online search history) and therapy that worked for each cancer patient along with the labels identifying the type of cancer they posses or if they were benign. Using classification technique, this dataset can be categorised by the cancer types, for instance skin cancer, lung cancer, breast cancer etc.

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By using pattern recognition technique on classified dataset, the cognitive system can be trained to spot a pattern and risk factors that can point to potential cancer it can determine the potential symptoms and warning signs by identifying the patterns of symptoms and behaviours within accessible data sets that could be used to indicate the presence of a cancer. In addition, it could also help in in determination of lifestyle risk factors such as tobacco use, diet and obesity, lack of exercise, alcohol consumption, and excessive exposure to sunlight etc.

By using image recognition technique on each category of classified dataset, the cognitive system can be trained using image of x-ray, ultrasound, MRI as raw pixel along with associated cancer type, to differentiate between a malignant tumour from a benign one and thus assist doctors to diagnose more accurately and quickly.

For instance, cognitive system can distinguish whether a patient mole is harmless or potential skin cancer just by processing the image of the mole. It can also detect signs of breast cancer by processing mammograms earlier than humans are currently capable of, even if there is clearno tumour on the mammograms, and can spot that minuscule change in very complex images that would hint at a wrong development which otherwise very hard for a human eye to quantify the changes but not for cognitive system as it is trained at millions of these images.The ability to distinguish between a malignant tumour from benign would greatly assist doctors in improved diagnosis for challenging tumour and provide better management of patient.

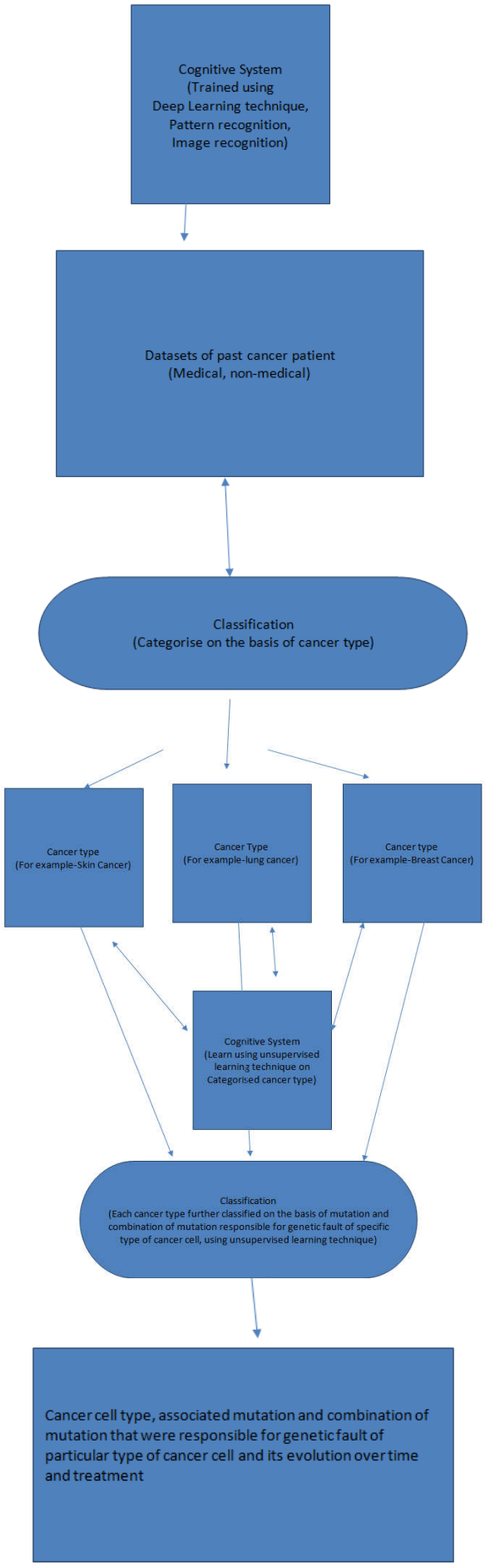
Furthermore, Cognitive system can be trained to learn what therapy worked for specific category of cancer patient and can be used to recommend the new cancer patient by taking their medical records as input, extracting pertinent information and return a series of suggested more personalised treatment options that worked for patient having same cancer feature, similar medical history and cancer cell type.

Consequently, every cancer category can be further classified.Using unsupervised learning cognitive system can be made to learn mutation and combination of mutation that was responsible for genetic fault causing cancer.It can learn to spot change in genetic fault in same cancer tumour with time and during treatment, detect genes likely to be involved in resistance of drug that worked well previously and can use this to find out if drugs that block these genes should be used in combination with existing treatment.

Since same cancer type tumour may contain different type of mutation that causes genetic fault; a concept of single “magic bullet” cure cancer drug is out of reach, so by identifying all mutation and combination of mutation in same tumour, cognitive system can assist pharmaceutical companies to develop targeted drugs that directly exploits these genetic and molecular faults without being toxic to normal cell.

In addition, detecting change in genetic faults in same cancer tumours with time and during treatment, would assistpharmaceutical companies in developing molecularly targeted drugs for all cancer genes for finding “intelligent” treatment combinations that can overcome acquired resistance and ensure patients keep benefiting from targeted drugs without being toxic to normal cell.

Block diagram captures the idea how cognitive system will work



Potential Application

1) The cognitive system can be trained using image recognition technique to identify other ailments apart from cancer that relied on examination of x-rays such as heart disease and scans to spot early warning signs of developing problems. This can be used to detecting common cause of blindness in image of retina.
2) The cognitive system can be used to determine other risk factors and specific marker that may leads to cancer. For instancelifestyle risk factors such as tobacco use, diet and obesity, lack of exercise, alcohol consumption etc.
3) Cognitive system can be used assist pharmaceutical companies in developing molecularly targeted drugs for all cancer genes and in finding "intelligent" treatment combinations that can overcome acquired resistance and ensure patients keep benefiting from targeted drugs.
4) Cognitive system can be used to recommend the new cancer patient by taking their medical records as input, extracting pertinent information and return a series of suggested more personalised treatment options that worked for patient having same cancer feature and similar medical history and cancer cell type.
5) Can help in early diagnosis of cancer by identifying the patterns of symptoms and behaviours within accessible data sets that could be used to indicate the presence of a cancer.
6) Cognitive system would assist doctors to diagnose cancer more accurately and quickly, it can extrapolating the type of tumour so as to successfully predicts its evolution over time and hence could facilitate doctor to go one step ahead of cancer and prescribe accordingly.
7) Cognitive system can be usedgive people advice on ways to engage in activities to improve their health.
8) Cognitive system can be in other fields by integrating with relevantdatabase for instance It can be integrated with finance database and could give business related advice.

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