Introduction

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Abstract

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1 Introduction to Cancer

* what is cancer?
* Cells proliferating * DNA messed up * variety of cancer
* some ok (e.g.: mole/freckle)
* some not ok, worse make the human die
    * who is concerned?
* more and more ppl, demographic figures
* environment impacts the probability of getting cancer (e.g.: UV exposure)
* living habits (e.g.: smooking)
* genetic impacts as well (e.g. "cancer gene")

* possible treatments
* there main, quick comparison
* say which treatment is mostly used

  * 10 cancer markers / cancer is "smart"
* cell proliferation
* reprogram cellular metabolism
* stop cell growth arrest
* evade apoptosis
* escape immune system
* ability to undergo a sufficient number of successive cell cycles of growth and division to generate macroscopic tumors
* create new blog vessels to get nutriments
* allow cell escape and metastasis formation
* change cellular response phenotypic via plasticity
* senescence

  * cancer can be considered as a living thing on its own
* beyond the cellular level, impacting tissues

  * 4 cancer conditions
* mutation
* epigenetic reprogramming
* inflammatory context
* disruption of microbiota

  * phases of cancer
* initiation
* promotion
* tumorigenesis + neoangiogenesis
* evolution (local, regional, metastasis)

  * cancer classification:
* tumor, node, mestastasis
* stages classification:
* stage 0 which corresponds to a so-called in situ tumor
* stage 1 which corresponds to a single, small tumor
* stage 2 which corresponds to a larger local volume
* stage 3 which corresponds to invasion of the lymph nodes or surrounding tissues
* stage 4 which corresponds to a wider extension in the body in the form of metastases

  * cancer causes
*(various reasons why: environment, inherited mutations, mistake in DNA copy)

  * personalized treatments
* revolution

* rapid advances
* help of mathematics
* help of AI

2   Introduction to Mathematical Optimization

* optimization def: selection of a best element, with regard to some criteria
    * in math: more precisely: optimization problem consists of maximizing or minimizing a real function by systematically choosing input
    * notion of allowed set
    * discrete vs continuous optim
    * many real-world and theoretical problems may be modeled in continuous general framework.
    * max(f) <=> min(-f) hence only min
    * notion of local vs global min
    * feasibility
* existance
    * optim algos
* 1st order
* gradient descent
* line search
* quasi-newton methods
* 2nd order
* newton's method
* 0th order
* brute force
* heuristics

    * least squares
    * multi-objective optimization

3   Introduction to Artificial Intelligence

* quick def
    * general idea
    * common architetures
* FC
* MLP
* CNN
* RNN
* transformers

    * Machine learning vs Artificial Intelligence vs Deep Learning
    * applications

* learning types
* surpervised
* un-supervised
* self-supervised
* reinforcement / semi-supervised

* tasks
* classical tasks
* regression
* classification
* partitioning
* dimension reduction
* generative AI
* images => training is difficult
* text

* recent progress
* computer vision
* playing games (a way to assess intelligence)
* image generation
* text generation