DAY 1 -2

LUNG CANCER
STAGING
TYPES
TREATMENT
ERROR ANALYSIS

- Introduction to lung cancer and statistics.
- Overview of lung cancer types, staging, and diagnosis/treatment.
- Receive transparencies and identify lung cancer nodules.
- Is it cancer or not? Which stage or type?
- Students compare and analyze similarities and differences between each group by overlaying transparencies.
- Is this process subject to human error?

DAY 3-4

3-D SLICER
TUTORIAL
ANALYSIS

- Introduction to 3-D Slicer.
- Use 3-d Slicer to segment lung cancer nodules.
- Research using vetted sources perspectives.
- 3-d print segmented nodules.
- Analyze differences.
- Compare transparencies to 3-d printed nodules.

DAY 5-7

INTRO TO MACHINE LEARNING & AI
RESEARCH
DEBATE
CAREER CONNECTION

- Introduction to machine learning and artificial intelligence.
- Poll students to solicit opinion(s), in favor of AI, against, undecided.
- Research using vetted sources perspectives.
- Debate in class.
- Invite UCF CRCV members to participate in the debate.
- Field Trip to UCF

University of Central Florida

CENTER FOR RESEARCH IN COMPUTER VISION

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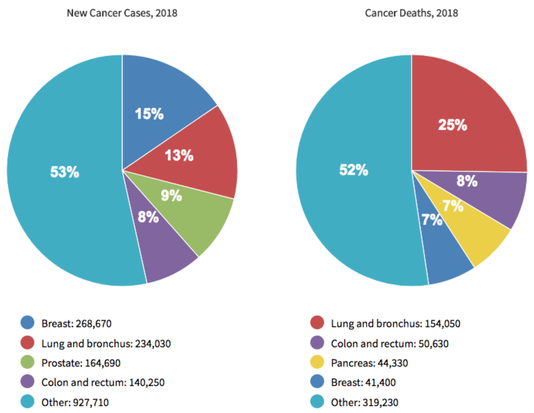
Integration Theme: How Low-Dosage Computed Tomography (LDCT) Scans and Computer-Assisted Detection (CAD) systems aid in early identification of potentially life threatening lung cancer nodules.

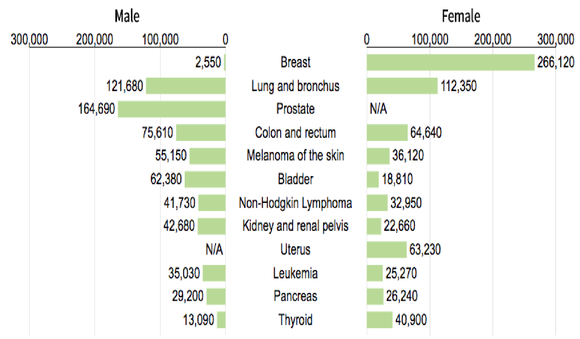
Mission

As part of Research Experience for Educators (RET) the primary mission of the project is to expose Advanced Placement Biology high school students to the field of computer vision by providing them with a learning experience that both advances their knowledge in a specific biological topic while simultaneously integrating concepts and tools typically encountered in the field of computer vision.

Background

There are three main types of lung cancer. Non-small cell lung cancer is the most common type and 86% of lung cancer cases are categorized as non-small cell lung cancer. 10-15% of cases are categorized as small cell lung cancer also known as oat cell cancer tends to spread quickly. Less than 5% of cases are categorized as lung carcinoid tumors also known as lung neuroendocrine tumors. These tumors typically grow slowly and rarely spread. According to the National Cancer Institute, lung and bronchus, colorectal pancreatic, and breast cancers are responsible for nearly 50% of all deaths as well as all new cases (fig1). In 2018, roughly 1.7 million people will be diagnosed with cancer in the United States. Lung and bronchus cancer is the second most common cancer diagnosis with an estimated 234,030 new cases (fig2). After a patient has been diagnosed with lung cancer the cancer is staged from 0-4. Current testing methods for lung cancer include imaging tests such as x-rays or low-dose spiral computed tomography scans (LDCT) , positron emission tomography (PET) scans, magnetic resonance imaging(MRI). An x-ray can detect a nodule as small as 10-20mm versus a LDCT scan that can detect a nodule as small as 6mm. Other methods of detecting lung cancer include sputum cytology (detected in sputum from coughing), tissue sample (biopsy). In recent years LDCT scans has become an increasingly used method due to the superior ability to form three-dimensional (3-D) images of the chest, which allows for greater resolution of nodules and tumor pathology. However, there is still a very high false positive rate which can be as high as 50 percent and can lead to secondary invasive tests. Identifying the best method of detecting cancer and refining the process to become more accurate will not only save money but ultimately will save many lives. This intersection between biomedical science and computer science is a great application of real world problems and potential solutions that can be derived from the intersection of these two disciplines.





Source: Estimated New Cancer Cases and Deaths for 2018

AP Biology & Computer Science Integration

AP BIOLOGY CLASSROOM INTEGRATION

Big Idea 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.

Essential knowledge 3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.
Essential knowledge 3.E.1: Individuals can act on information and communicate it to others.
Essential knowledge 3.E.2: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.

Enduring understanding 3.A: Heritable information provides for continuity of life.
3.A.1: DNA, and in some cases RNA, is the primary source of heritable information.
3.A.2: In eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis or meiosis plus fertilization.
3.A.3: The chromosomal basis of inheritance provides an understanding of the pattern of passage (transmission) of genes from parent to offspring
3.A.4: The inheritance pattern of many traits cannot be explained by simple Mendelian genetics.
Enduring understanding 3.B: Expression of genetic information involves cellular and molecular mechanisms.
3.B.1: Gene regulation results in differential gene expression, leading to cell specialization
3.B.2: A variety of intercellular and intracellular signal transmissions mediate gene expression.
Enduring understanding 3.C: The processing of genetic information is imperfect and is a source of genetic variation.
3.C.1: Changes in genotype can result in changes in phenotype.
3.C.2: Biological systems have multiple processes that increase genetic variation
3.C.3: Viral replication results in genetic variation, and viral infection can introduce genetic variation into the hosts.
Enduring understanding 3.D: Cells communicate by generating, transmitting and receiving chemical signals.
3.D.1: Cell communication processes share common features that reflect a shared evolutionary history.
3.D.2: Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling
3.D.3: Signal transduction pathways link signal reception with cellular response
3.D.4: Changes in signal transduction pathways can alter cellular response
Enduring understanding 3.E: Transmission of information results in changes within and between biological systems.
3.E.1: Individuals can act on information and communicate it to others.
3.E.2: Animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce responses.

AP BIOLOGY REQUIRED SCIENCE PRACTICES:
SP 5.1 . . .analyze data to identify patterns or relationships.
SP 5.2 . . .refine observations and measurements based on data analysis.
SP 5.3 . . .evaluate the evidence provided by data sets in relation to a particular scientific question.

References

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