

# IMAGING INFORMATICS: OPEN-I ® UPDATE

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# OPEN-I GOALS

- Enhance users' search experience
- Provide direct access to relevant images from image databases and literature
- Improve relevance of biomedical literature search results by targeting the visual content in articles
- Find information relevant to a patient's medical case



# OPEN-I USER INTERFACE

The screenshot displays the OPEN-I user interface in a web browser. The main search bar contains the term "toxicity", and a dropdown menu lists related search suggestions such as "toxicity drug", "toxicity radiation", and "toxicity renal". The search results page is titled "toxicity - Search Results" and shows a grid of various scientific images and diagrams. A prominent text box highlights a study titled "Permitted water pollution discharges and population cancer and non-cancer mortality: toxicity weights and upstream discharge effects in US rural-urban areas." by Hendryx M, Conley J, Fedorko E, Luo J, Armistead M (Int J Health Geogr (2012)). The text box includes a "Bottom Line" summary and a "F6" note. The interface also features navigation options like "Limits", "Rank By", and "Image Type", and a "Selected Limits" section.

**Permitted water pollution discharges and population cancer and non-cancer mortality: toxicity weights and upstream discharge effects in US rural-urban areas.**  
Hendryx M, Conley J, Fedorko E, Luo J, Armistead M (Int J Health Geogr (2012))

**Bottom Line:** Greater non-carcinogenic chemical discharge quantities were associated with significantly higher non-cancer mortality rates, regardless of toxicity weighting or upstream discharge weighting. The geographically weighted regression results suggest spatial variability in effects, and also indicate that some rural communities may be impacted by upstream urban discharges. Toxicity weights and upstream discharges are important for understanding some mortality effects.

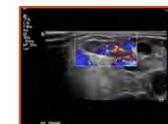
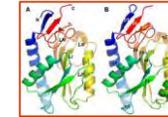
**F6:** Regions where weighting the releases by **toxicity** versus not weighting the releases by **toxicity** had the greatest local correlation with all-cancer mortality.

<https://openi.nlm.nih.gov/>

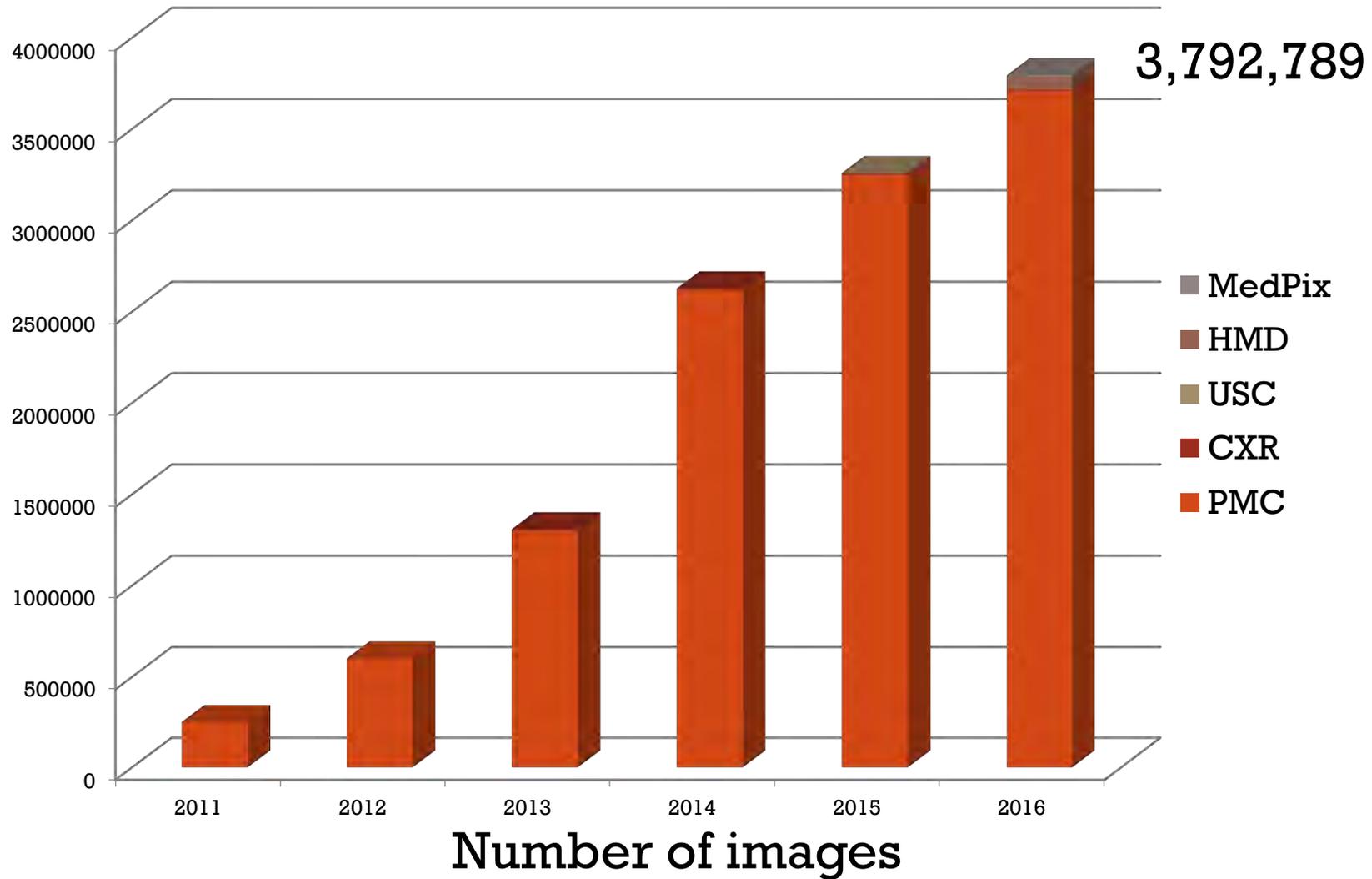


# OPEN-I DATA SOURCES

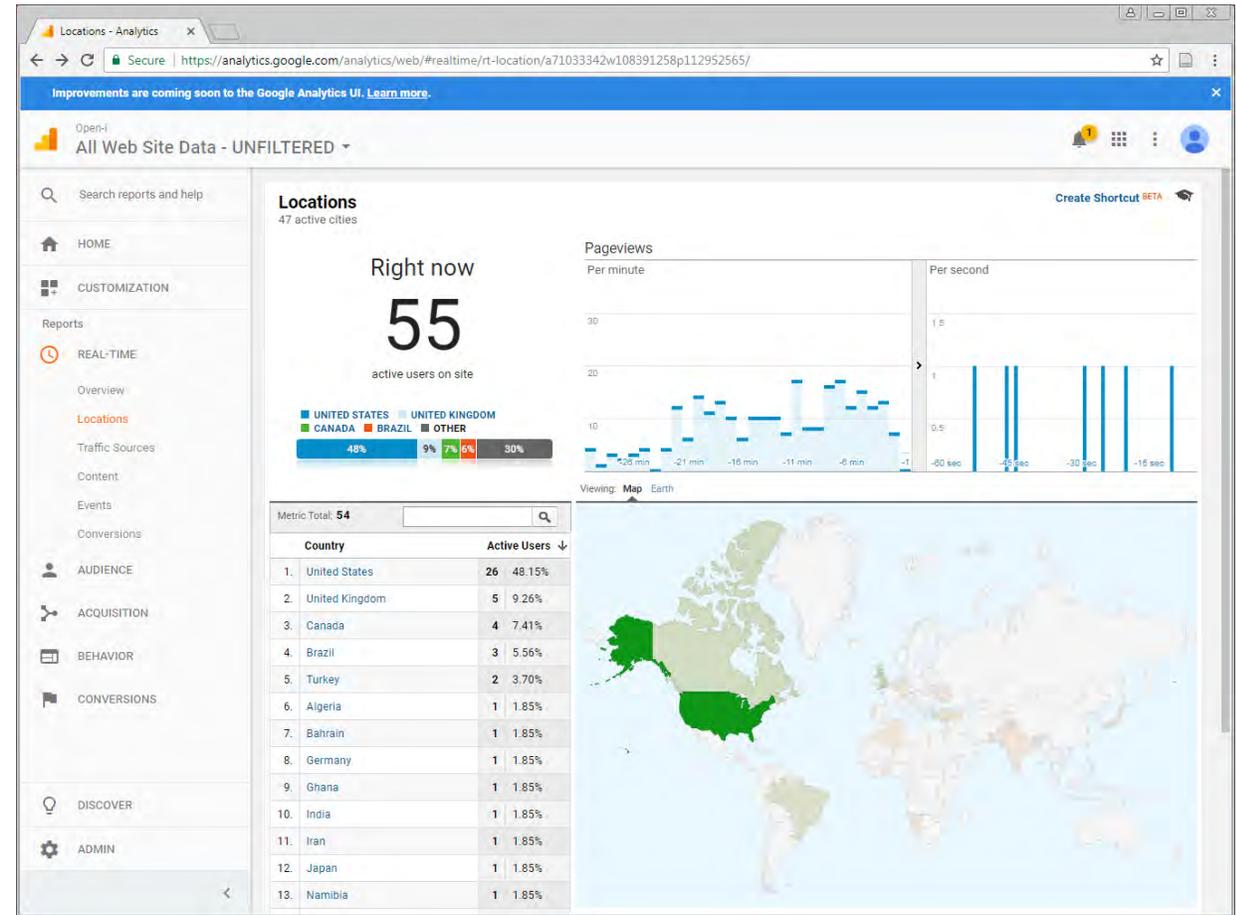
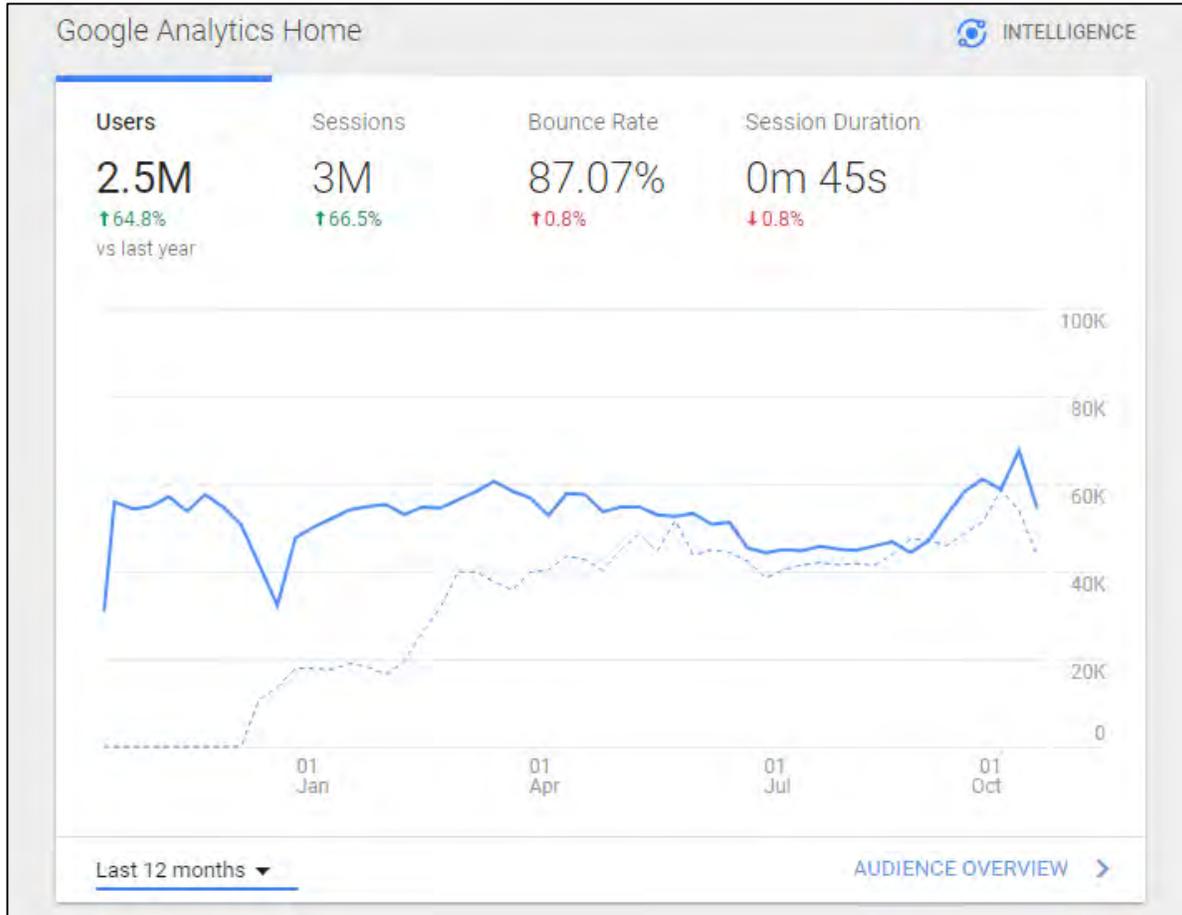
- The Open Access Subset of PubMed Central (PMC)
  - Articles: 1,139,338
  - Images: 3,707,654
- Chest X-rays from the Indiana University hospital network (CXR)
  - Radiology reports: 3,955
  - Images: 7,470
- USC Digital Library Orthopedic Surgical Anatomy Teaching Collection (USC)
  - Images: 2,064
- Images from the NLM History of Medicine Division (HMD)
  - Images: 67,517
- MedPix
  - Cases: 1,761
  - Images: 8,084



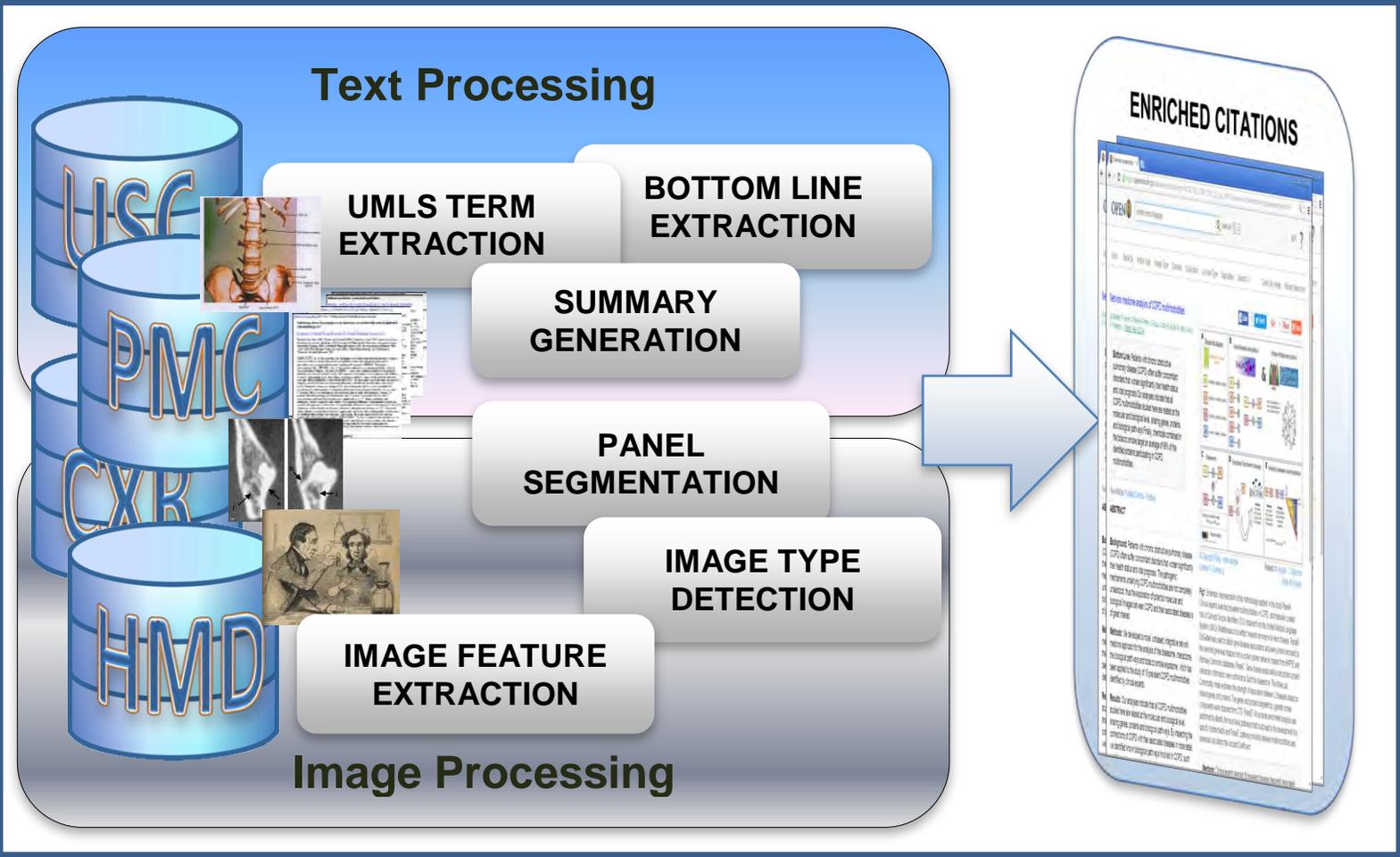
# OPEN-I DATA GROWTH



# OPEN-I USERS



# PREPARING CITATIONS FOR INDEXING



# CITATIONS ENRICHED WITH TEXT AND IMAGES

openi.nlm.nih.gov/detailedresult.php?img=PMC4531798\_13058\_2

OPEN  view as

**Multi-panel figure & caption segmentation**

Reduced proliferation in breast cancer cells contacting the neighboring adipocytes in human breast cancer tissues.

Ryu HS, Lee HB, Han W, Noh DY, Moon HG - [Breast Cancer](#)

View Article: [PubMed Central](#) - [PubMed](#)

**PubMed citation**

**Automatically generated summary**

Please rate it. ★★★★★

The process of tumor formation and progression is a result of the complex interaction between malignant epithelial cells and the various cell populations in the tumor microenvironment... Recently, the role of cancer-associated adipocytes in cancer progression has been an active area of research, and many studies have suggested a proinvasive and prometastatic effect of the cancer-associated adipocytes... To overcome the issue of intertumoral heterogeneity, we semiquantitatively analyzed the histologic grade of cancer cells on the adipose side and on the gland side within the same tumor in 107 patients whose tumors had moderate tumor–adipose contact (between 0.4 and 0.6; Fig. 1d)... We measured the degree of the tubule formation, nuclear pleomorphism, and mitotic count, which are the three components of the widely used Elston–Ellis modification of the Scarff–Bloom–Richardson histologic grading system for both adipose-side and gland-side tumor cells... The tumor cells on the adipose side showed significantly lower mitotic index when compared with that of the tumor cells on the gland side... The significant association with mitotic index and the cancer cells' distance to the adipose tissue was only seen in estrogen receptor-negative breast tumors (Fig. 1e, representative case shown in Fig. 1f)... There was no significant difference between the adipose-side and gland-side cells in tubule formation and nuclear pleomorphism... In conclusion, our analysis of human breast cancer samples showed that tumor cells residing close to the adipose tissue showed significantly lower mitotic count than cells distant from the adipose tissue... Our findings suggest that, contrary to the prevailing concept of the cancer-promoting role of cancer-associated adipocytes, the true interaction between cancer cells and the neighboring adipose tissue can be a complex one.

No MeSH data available.

Related in: [MedlinePlus](#)

**Mention**

**Fig1:** Adipose–tumor interaction and the histologic grades of tumor cells. a Representative gross photograph showing the tumor area in contact with surrounding adipose tissue (white arrows) and gland tissue (black arrows). b Design and exclusion criteria. c Association between various clinico-pathologic factors and the degree of tumor–adipose contact. \*P < 0.05. ER, estrogen receptor; HER2, human epidermal growth factor 2; HG, histologic grade; PR, progesterone receptor. d In 107 patients whose tumor showed moderate tumor–adipose interaction, the degrees of mitotic index, nuclear pleomorphism, and tubule formation were measured in adipose-side tumors and gland-side tumors. e The gland-side tumor cells showed significantly higher mitotic index especially in ER-negative tumors, suggested by the changes in mitotic index within same tumors. P values derived from the comparison using the Wilcoxon signed-rank test. f Representative case of a tumor with significant changes in mitotic index according to the tumor cells' location with regard to surrounding adipose tissues

**Mentions:** Human breast tissue has a unique architecture of adipose tissue surrounding the mammary glandular tissues. Many human breast cancers face the adipose tissue during their growth, and therefore there is direct contact between cancer cells and adipocytes. We have reviewed representative photographs of the 1,052 macroscopic surgical specimens of breast cancer resected between January 2006 and July 2007. This study was approved by the institutional review board (1208-046-121). In 528 patients, we were able to measure the relative ratio of



# SUMMARY GENERATION

- **Problem: 50,000 articles in the open access subset of PMC have no abstracts.**
- **Solution: automatic summarization**
- Bottom-line extractor + key-phrase extractor
  - Outperforms the best individual summarizer by 35%
- Top 10 sentences in the order of occurrence in the article
- Key-phrase extractor
  - KEA to identify most salient words
    - Outperformed an alternative key-phrase extractor by 25%
  - Sentences with high density of distinct salient words



# OPEN SUMMARIZER: SUMMARY EXTRACTION AVAILABLE AS SERVICE

<https://openi.nlm.nih.gov/summarizer.php>

Drop PDF - OR - [Select PDF](#)

Integrated flood hazard assessment based on spatial ordered weighted averaging method considering spatial heterogeneity of risk preference

flood hazard assessment under different optimistic or pessimistic strategies. It concluded that the hazard estimation result was greatly influenced by decision maker's attitudes towards risk. However, that the unified risk preference was applied in entire area usually resulted in underestimation of flood hazard which may neglect the area that is actually at risk, or the overestimation which consumed the unnecessary extra attention from the decision makers. The proposed approach overcame this disadvantage through considering the spatial heterogeneity in spatial risk preference assignment. The index derived from the comprehensive consideration of GDP and population distribution was used for the assignment of risk preference. It was helpful for decision makers to focus on the flood hazard area for potential loss reduction and make effective enhancement strategies with limited resources.

Nevertheless, there is much research still needed to be done to improve flood hazard evaluation. As the terrain data play a very important role in the estimation, the availability of high resolution and high precision DEM can further enhance the capability to evaluate the flood hazard. In addition, as limited by the availability of data, the region importance was estimated just from the aspects of GDP and population in this study. Other factors associated with socio-economy and ecology could be incorporated to make the estimation more comprehensive. Though there exist restrictions on data in this study, it provides an alternative way of assessing flood hazard, which is of significance for decision makers to identify the flood hazard area so as to implement flood management strategies.

[SUMMARIZE](#)

### Summary

In this study, a framework of multi-criteria analysis (MCA) incorporating geographic information system (GIS), fuzzy analytic hierarchy process (AHP) and spatial ordered weighted averaging (OWA) method was developed for flood hazard assessment... In the current study, we developed an integrated flood hazard assessment framework, combining fuzzy AHP and spatial OWA method in the integration process... Finally, the flood situation under different unified risk preference scenarios was analyzed, and the spatial OWA based flood hazard assessment method was applied to generate the flood hazard map... In this study, spatial multi-criteria analysis and evaluation framework based on fuzzy AHP and spatial OWA method has been developed and implemented in the case study area for flood hazard assessment... Then flood hazard situations with regard to different global risk preference were simulated and analyzed, which provided effective comprehending of the strategies under different risk attitudes and suggestions for the use of risk preference in spatial OWA model... The aggregation result ( $U_i$ ) is calculated as the following (Malczewski, 2000):  $(4)U_i = \sum jw_jx_{ij}$  Criteria weight analysis The result of criteria weights derived from fuzzy AHP... The flood hazard assessment map was divided into five classes by using natural break method (Berry and BenDor, 2015; Kazakis et al., 2015) which properly group the similar values and maximize the difference between different classes, i.e., very low hazard, low hazard, moderate hazard, high hazard, and very high hazard... The results are shown in Fig.6... We also made flood hazard assessment under different optimistic or pessimistic strategies... It concluded that the hazard estimation result was greatly influenced by decision maker's attitudes towards risk... In

Related Sites: [OPEN](#) [MedPix](#) [Case UP load server](#)

**Flood events, OWA, risk preference, risk attitudes, flood hazard assessment, fuzzy AHP**

Integrated flood hazard assessment based on spatial ordered weighted averaging method considering spatial heterogeneity of risk preference.



# OPEN-I<sup>®</sup> & MEDPIX<sup>®</sup> CASE SUBMISSION SERVER

**MedPix – system for teaching clinical imaging developed by Dr. James Smirniotopoulos**

- MedPix provides 830 CME Teaching File Cases
- Developed case submission server
  - For submission, editing and publication of case reports to Open-i and MedPix

The screenshot displays the Case Upload server interface. At the top, there is a navigation bar with the 'UP Case Upload server' logo and a user profile for Soumya Gayen. Below this, a sidebar on the left shows a list of case statuses: Ongoing, Submitted, Approved, Published, Editorial, and All Cases. The main content area is a table of submitted cases, each with a thumbnail image, title, author information, and submission date. A detailed view of a case is shown on the right, including patient demographics, history, and physical exam findings.

Case Title	Author	Date	Actions
COLORECTAL SIGNET-RING CARCINOMA	aeja.weiss@usuhs.edu	2017-08-24	View, Share, Info
Cauda equina fungal intradural abscess presenting with hydrocephalus	vitalynatkha@gmail.com	2017-08-24	View, Share, Info
Marine with hand injury	kevin.a.climaco@gmail.com	2017-08-13	View, Delete, Share
Insidious SCC	barak.c.clement2.mil@mail.mil	2017-08-02	View, Share, Info
Rare Earth Magnets	angelbelgard@gmail.com	2017-07-29	View, Share, Info
Neurofibromatosis Type 1	swilliams0157@gmail.com	2017-07-27	View, Delete
Malignant Mesothelioma	kronennj@gmail.com	2017-07-27	View, Share, Info
Diagnostic Imaging of Trauma - Comparative Assessment	ggerow@roadrunner.com	2017-07-20	View, Delete
Evaluation of Knee Trauma	ggerow@roadrunner.com	2017-07-20	View, Delete



# USE OF OPEN-I API

- **NICHD Placental Atlas Tool**

- The Placental Atlas Tool provides access to a comprehensive, centralized placental knowledge base, analytics tools, relevant research, publications, and resources.

- ***Note: This is a mock up and the PAT system won't be live until the end of the calendar year.***

The screenshot displays the NICHD Placental Atlas Tool website. At the top, the NIH logo and 'PLACENTAL ATLAS TOOL' are visible. Navigation links include 'Publication Explorer', 'Dataset Explorer', 'Image Explorer', 'Taxonomy Browser', 'Resources', and 'NEWS'. A 'My Workspace' and 'Log Out' link are in the top right. The main content area features a large image of a pregnant woman being examined, with a 'Welcome to the Placental Atlas Tool' message and a 'LEARN MORE' button. A green sidebar highlights 'Analytical Tools' with an 'EXPLORE' button. Below, there are sections for 'Placenta Related Resources' (listing various initiatives and fellowships), 'Upcoming Events' (listing meetings in July, August, and October), and a central image of a placental MRI scan.



# PLACENTAL ATLAS IMAGE EXPLORER

An Image Explorer displays thumbnails of Open-i images and relevant metadata, linked to any publications NICHD have in the system, and linked back to the Open-i detailed view page.

The screenshot displays the NIH Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD) Placental Atlas Image Explorer interface. The main content area shows a heatmap visualization of differentially expressed transcripts, organized into eight panels (A-H). Each panel contains a dendrogram on the left and a heatmap on the right, with a color scale from green (low expression) to red (high expression). The heatmap shows expression profiles for transcripts in the hormone pathway across various stages of leaf development. The y-axis represents the expression levels of the genes.

Image Source: U.S. National Library of Medicine Open-i

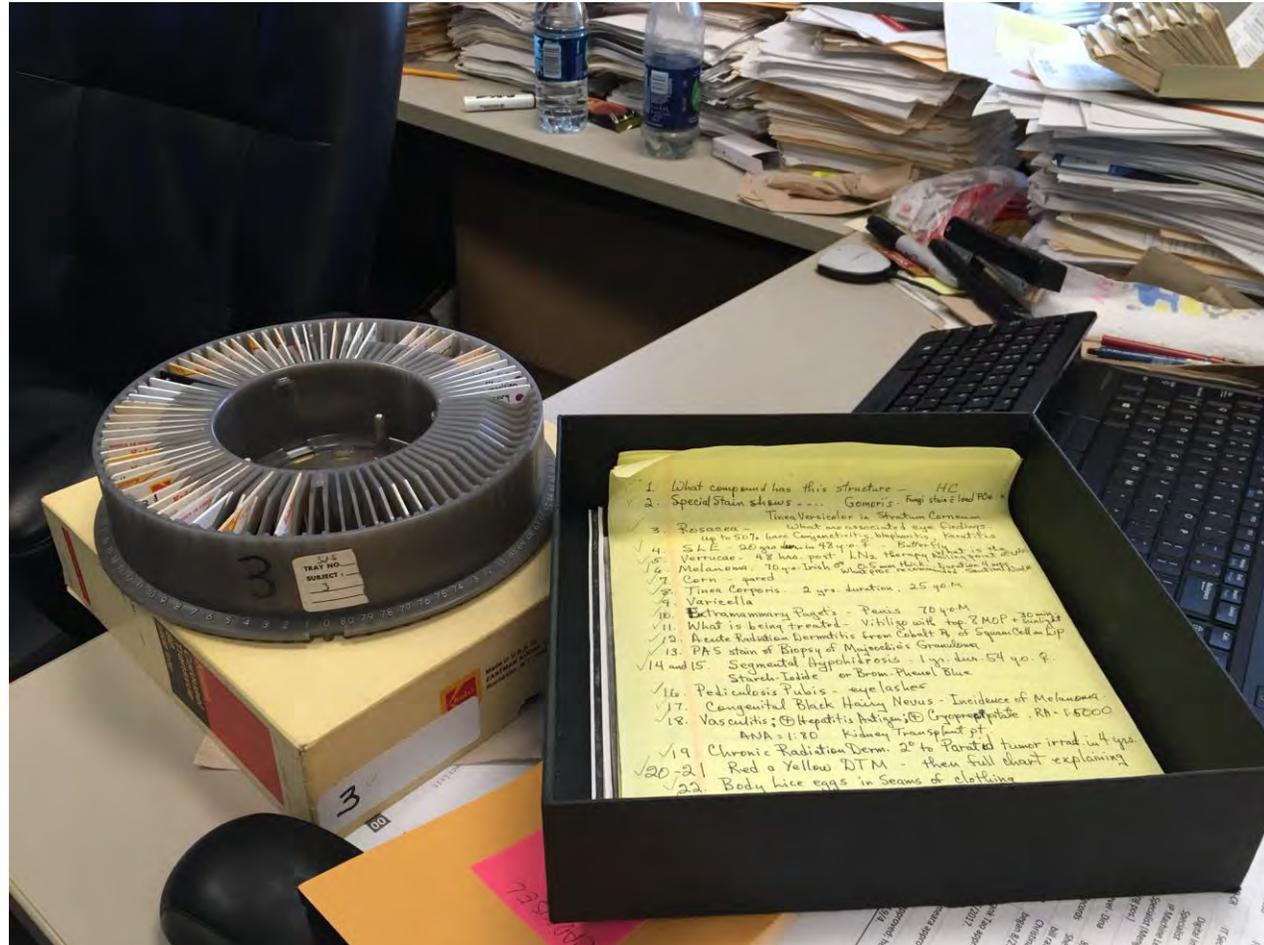
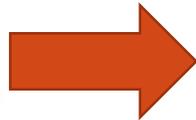
Hierarchical cluster analysis of differentially expressed transcripts involved in each hormone pathway during senescence. A. abscisic acid, ABAB. auxinC. cytokinin, CKD. brassinosteroid, BRE. ethylene, ETF. Gibberellic acid, GAG. salicylic acid, SAH. jasmonic acid, JA. The left hand map illustrates the expression profiles for transcripts in the hormone pathway the right heat map illustrates the expression profiles of transcripts mentioned in the context of hormone. The x-axis refers to each stage of leaf development. The y-axis represents the expression levels of the genes.

PMCID: 4342795

The interface also includes a search bar, a filters section with modality and major mesh categories, and a navigation menu with options like 'Publication Explorer', 'Dataset Explorer', and 'Image Explorer'.

# OBTAINING NEW COLLECTIONS

- Dermatology collection



Clem McDonald

Rodney Long



# WORKING ON ANSWERING QUERIES SUCH AS “WHAT ARE THE ULTRASOUND FINDINGS IN CHILDREN WITH APPENDICITIS”

- ImageCLEFcaption 2017 evaluation (Asma Ben Abacha)
  - Concept detection
  - Caption prediction
  - Open-i-based approach ranked first over all runs in the challenge (11 groups, 71 runs)
  - Deep Learning (CNN, GoogLeNet) second best in the ranking of runs without the use of external resources
- Started exploring Visual Question Answering based on MedPix /Open-i (Jason Lau)



## Concepts:

- C0016911: Gadolinium
- C0021485: Injection of therapeutic agent
- C0024485: Magnetic Resonance Imaging
- C0577559: Mass of body structure
- C1533685: Injection procedure

**Caption:** Magnetic resonance imaging. After intravenous injection of gadolinium, the mass showed a progressive, heterogeneous, and delayed enhancement.

