Pancreatic Cancer Diagnosis, Detection and apoptosis through PEGylated zinc oxide nanoparticles

A. Bhanu Prakash **N. Sai Krishna**
Asst Professor **Asst Professor**
Dept of EEE
Sree Dattha Institute of Engineering and Science

ABSTRACT
Pancreatic tumor is considered one of the most lethal diseases worldwide. Identifying pancreatic tumors in the early stages is a difficult task because symptoms unique to cancer only appear in advanced stages, and there is a lack of a definitive screening device to examine high-risk people. Machine learning (ML) can be utilized as a potent technique for early-stage diagnosis of pancreatic cancers. In this discussion, we will examine various diagnostic tools for pancreatic cancer and explore the use of artificial intelligence techniques to detect the disease. These approaches aim to identify significant patterns and provide precise information to pathologists and treatment methods at a very small scale.

Keywords- pancreatic cancer, optical coherence tomography, mass spectrometry, support vector machines, fully convolutional neural networks, zinc oxide nanoparticles

I. INTRODUCTION

In the world the one amongst the subsequent driving reason for casualty is cancer [1]. Pancreas, the organ which is a part of the digestive system does endocrine and exocrine functions. The human glucose homeostasis alongside insulin is emitted by pancreas with its islets β-cells [2].

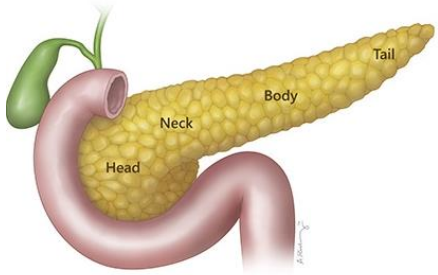

Fig. 1 Anatomy of pancreas gland

In Pancreas the malignant growth (PC) will be a disease which is tough in its physical identification. On this ground as pancreas organ being deep inside the body; there may not be exterior irregularities or exterior skin changes as in breast cancer [3]. Likewise, vague side effects, for example, queasiness, anorexia, jaundice, weight reduction, and stomach ache are additional reasons in the trouble of identifying pancreatic tumors in the beginning stage [4]. Furthermore, there are no solid screening alternatives are accessible for PC, so it will in general be analyzed in future when the disease has developed and escalated. The trouble in distinguishing pancreatic cancer early outcomes much of the time of pancreatic disease being analyzed late. PC is a low endurance cancer, previous perseverance rates (5-year) were represented generally imperative in testicular malignancy development (98%) and (95%) prostate disease. All these in pancreatic tumor development (9.1%) and in mesothelioma (5.8%) were generally negligible.This tumor development remains one amongst the damaging tumors. Presently, numerous screening methodologies for this disease are needed to decide its quality. It is the twelfth most normal kind of malignant growth with around 460,000 cases in 2018 [5] and is additionally one of the deadliest with an expected endurance pace of 9% [6].

There are a few PC hazard factors. Those that are way of life related incorporate smoking, stoutness, being overweight, and work environment introduction to specific chemicals; while different aspects are family ancestry, acquired quality disorder, diabetes, and age. The danger of growing PC enhances as individuals get older [7]. Various sorts of cystic lesions like benign or malignant can be seen in this type of cancer. The predominance of pancreas cystic lesions fixation is irregular, assessed somewhere in the range of 2% and 38% as per the investigations [8]. The cystic neoplasms of the pancreas were classified into three main categories by W.H.O [9, 10] (described in table 1).

Table. 1 Lesion Pancreatic cystic categories

Cyst Category	Description	Malignant Potential
Serous cystadenoma [11]	Generally this type of tumor occurs in old people that too dominantly in ladies.	Benign
Hydatic Cyst[12]	This is benign and occurs very rare. When the location is isolated or unique diagnosis becomes difficult, therapeutic problems may also arise.	
Intraductal Papillary Mucinous Neoplasms[11]	spectrum of neoplasms-the reproduction or rapid growth in the epithelium lining of the side branch ducts or in the main pancreatic duct	Borderline
Mucinous cystadenoma[11]	Mucinous epithelium is in Bordeline, This belongs to the category of cystadenoma (cystic adenoma). Mucinous cystadenomata occurs in various locations but not related to each other.	
Cystic Neuroendocrine Tumor[13]	Solid Lesions multiply, evolve as a cystic appearance alternatively to decay and necrosis	Malignant
Solid-Cystic Papillary Epithelial Neoplasm[13]	Low degree malignant potential ,enormous, well enclosed mass with different internal structure, areas of hemorrhagic degeneration and focal signal deprived.	
Mucinous cystic neoplasm[10]	malignant potential with abnormal neoplasm thick gelatinous mucin filled , unilocular or multilocular cysts.	

The metastasis format and the cancer cell place point are done to affiliation different unsafe turns of events. Be that as it could, this relationship of assortment isn't for each situation regularly finished for pancreatic tumors at the time of recall that different victims with tumors have instigated illness and detest cautious sifting through [14]. The more significant system for depiction is to choose if the risk is circumspectly resectable, unresectable or outspreads resectable. Resectable PC is normally undermining advancement which is put up to the pancreas and may really be expelled with a Whipple framework beyond a fix earlier. Outskirts resectable agency is from time to time outlined as being guarded to the pancreas by constrained thought of near to veins that incorporate the unparalleled mesenteric reserve, most vital mesenteric vein, and segment vein [15]. Fringe resectable pancreatic tumors might end up resectable by neo ancillary fix. Unresectable bureau is depicted as being covertly incredibly extraordinary contamination which has progressed into or binds the more unmistakable piece of the outline of goliath veins or affliction, the indicated is metastatic. By and large 80% of pancreatic tumors are dismembered later the sullying has gotten subtly enhanced, having spread out to incorporate normal lymph community focuses [16]. Because of tricky logical course and vague part impacts the pancreatic harmful increment devotion is commonly late, with doubtlessly 15–20% giving possibly reparable affliction. It's miles, along those follows, fundamental to recognize the victims with PC at starting occasions of the disease while tumor is likely pleasing to cautious division. These periphery resectable and unresectable pancreatic tumors are deeply unified to perform a biopsy for having a cyto/histological confirmation of peril sooner than cure. In any case, for patients giving in an all around planned style resectable disease, the procedure of biopsy is an expanding number of immaculate to invalidate.

To expedient the clinical prerequisites in detecting the pancreatic disease in beginning stage detection, high-resolution imaging devices are very important in comprehending the tumor development structure and scattering arrangements at a cellular/subcellular-level. In PC determination, oncologists control various tests so as to distinguish the presence of the tumor and decide the degree of the state of a specific victim [17]. A few instances of the diagnosis tests are Magnetic Resonance Imaging (MRI), Computed Tomography (CT) Scan, Endoscopic Retrograde Pancreatography (ERP), Ultrasound,endoscopic ultrasonography (EUS) and Positron Emission Tomography (PET), radionuclide imaging (RNI) Scan [18-20]. Yet, they still experience the ill effects of specific confinements, for example, low resolution, constrained imaging profundities, low demonstrative sensitivities, and the ruinous idea of interpretative or needle ambition biopsies, just as troubles in acquiring the examples. In 2019, Xiaojun Yu et al. assessed the achievability of µOCT as a non-intrusive, high-goals imaging apparatus that gives celular/sub-cell level tissue small scale format pictures for pancreatic malady finding. Optical soundness tomography (OCT) is a developing imaging methodology dependent on low lucidness interrogatory [21]. By using a broadband laser source and estimating the extent and reverberation time postponement of the backscattered light, OCT is equipped for giving microstructure pictures of the natural cells noninvasively by run of the mill hub goals of~1-10 µm [22]. A commonplace µOCT framework, which

accomplishes a goal of~1.67µm in the hub heading and 1.79 µm in the parallel course, was built. Pictures of mouse, rodent and human pancreatic tissue examples were obtained, and contrasted with their comparing histology pictures for both format affirmations and typical/unhealthy tissue recognizable pieces of proof in various cases. The outcomes indicated about the typical pancreatic tissues, that the point by point pancreatic microstructures, e.g., veins, and the parenchyma and neighboring delicate tissues, i.e., the islet of Langerhans (IL) and the IL cell cores, were obviously recognized [23].

II. RELATED WORK

It is of imperative significance to propel finding the initial forecast and providing treatment in the beginning stage. The AI vows to take care of the issues in the wellbeing imagining territory, tallying framework helped discovering, radiomics, and restorative picture assessment. Significant Learning is creatively top tier in the framework portrayal region and ended up being very standard in various locales too. It started using in late 2012, at the time DEEP CNN conquered the test to practice in settling the PC helped seeing rivalry and ImageNet Classification. Thus investigators functioning in the areas like therapeutic imaging have started successfully checking out the exceptionally creating branch of significant research. Deep Learning, an AI branch utilizes neural systems with innumerable transitional concealed layers in the midst of the input and output layers. The system is trained on a bigger informational index to make a model whichever can be utilized to make exact expectations on unfamiliar test information. Every layer's prepared information is fed forward as contribution to the following layer. The model is enhanced reiteratively by invigorating the heaps of the relationship among the layers. If the target values and the expected values don't coordinate, at that point it shows the error. Again on every emphasis execution in regards to the forecasts of the model is seen to refresh the weights. The issue of distinguishing PC in the initial stages is a classification problem in machine learning. ML is acknowledged in different grouping issues for different branches, one amongst them is the branch of medication. In the branch of medication, a few AI techniques are utilized to distinguish a few sorts of malignancy, to be specific breast cancer [24–27], cervical cancer [28, 29], ovarian malignant growth [30, 31], colon malignancy [32], prostate malignant growth [33], and lung cancer [34]. Many learning techniques can be utilized, for example, decision tree, support vector machine, Bayesian belief network, recurrent neural network, random forest, plays a vital role in artificial intelligence. Table 2 figures out the summary of the related systems features:

Numerous examinations and explores have incorporated procedures, for example, machine learning algorithms, statistical methods, and scientific procedures in the recognition and classification of illnesses dependent on tests led. In 2020, Emmanuel Briones et al. examined pancreatic diagnosis support apparatus executing ML is to be made with support vector machines (SVM) algorithms and mass spectrometry information of PC victims and restrains as training and testing datasets. Make the location procedure simpler and quicker and yet solid using mass spectrometry information and machine learning. Mass spectrometry (MS), or mass spectroscopy, is an investigative apparatus utilized for estimating the atomic mass of a sample. It is an instrumental method that gauges the mass-to-charge proportion of particles, the aftereffects of which are ordinarily introduced as a mass range of mass/charge values of relating intensities [39]. Besides, means to make a PC identification support apparatus which executes ML utilizing mass spectrometry information, so as to help specialists in deciding if a patient has PC dependent on their mass spectrum. The mass spectrometry information was procured from the Global Natural Product Social Molecular Networking (GNPS) MS database site and the PRoteomics IDEntifications (PRIDE) Archive, all in mzml design. In view of the sum of the investigation and all obtained datasets, it is discovered that the qualities generally related to PC are in the extents 400-600 m/z. Likewise, the synthetic exacerbates that are typically distinguished in MS information of PC-analyzed patients are delanzomib, obtusin 2-glucoside, physcion 8-glucoside, trifolirhizin, and elvitegravir. This data is found using a substance mixes database, and questions with the m/z and force esteems as info esteems. A sum of six Radial Basis Function-Support Vector Machine (RBF-SVM) models was developed. For each model, a last 5-overlay Grid Search cross approval is made to guarantee that the hyper boundaries are enhanced. The SVM model five which is the one prepared, tried, and assessed on datasets with complete pre-handling generally had the most elevated scores in exactness, certainty, review, and f1-score beyond definite assessment on the datasets. Besides, GridCVSearch was utilized as to the whole procedure of cross approval and hyper parameter optimization [40].

Table. 2 Literature Review of diagnostic system for pancreatic lesion cysts

Analogous works	Techniques used	Cysts diagnosis	Precision	Advantages	Drawbacks	Medical Techniques
Chao Li et. al. 2016 [35]	-SVM classifier	-CM -CS	88.37%	The consolidation of traditional features and significant data	-cases from MRI investigated images were unsatisfactory	CT scans

				from dual-energy spectral CT exhibited high efficiency in the described CADscheme.	- limited data source -not considering cost of misclassification	
J.Surendiran et.al.2018 [36]	-Artificial neural Network	Malignant benign	72.8%	For texture feature extraction of the regions with disorder, DRLSE semi automated segmentation method of CT images is used	-only CT scans are used -a borderline class in cystic classes is lacking	CT scans
Hongwei Li et.al.2018 [37]	-Densely-Connected Convolutional Networks	IPMN -MCN -SPT -SCN	51,4%	- high level features are acquired from irregular pancreas. -For assisting the physicians to understand the decision saliency maps in the framework are integrated.	-database is not including demographic data - CAD approach is applied only after the pancreas is roughly segmented - only CT scans are used	CT scans
Sarfaraz H et.al.2018 [38]	- Convolutional Neural Network -SVM classifier -deep learning	-IPMNS	64.67%	- pancreas or cysts don't require manual segmentation - need no explicit data for having balance between positive and negative.	lack of data : inadequacy of clinical and demographic characteristics, counting age, family history, Antecedent symptoms.	MRI

The division of pancreas in CT pictures can help clinical work processes, including PC determination, treatment arranging, and surgical support, in numerous domains [41]. Automatic pancreas separation is a challenge because of the low delicate tissue diversity in CT pictures and huge anatomical deviations. The CT picture covers a huge area of the patient body yet the target organ is comparably small in size so a two-phase system is additionally intended to segment it powerfully from the coarse level to the fine level. In 2019, S.Liu et al. proposed an altogether-based multiloss fully convolutional neural network (FCN) to segment the target precisely in CT images. This methodology finds coarse pancreas superpixel through residual neural network (ResNet) over-division and characterization, a group model joined with five FCNs, which were trained with various target capacities and test the systems in three of 2.5D slice-by-slice picture input [42].

Pancreatic ductal adenocarcinoma (PDAC) is the most widely recognized histological sort of pancreatic disease [43]. Although the science and technology advanced well, the enhancement in the result of this carcinoma treatment is insufficient. There are a few treatment alternatives, but no method of treatment is compelling in controlling the disease increment and extinction rate. Gemcitabine has been an ideal care for the curing of pancreatic malignancy since 20 years and more, however as a solitary specialist gemcitabine isn't therapeudic. Since the main remedial alternative for the more than 80 percent of pancreatic malignancy patients ineligible for careful resection is chemotherapy with or without radiation, the most recent couple of decades have seen a critical exertion to create successful treatment for this disease. Chemotherapy is contemplated as one among the suitable alternative post-medical procedures or when analyzed in beginning phases; nonetheless, chemotherapeutic medications frequently brought about extreme unfriendly impact contrasted with its clinical advantages [44]. Extreme unmanageable abdominal pain emerging from locally intrusive PC has an impressive negative effect on personal satisfaction [45]. A noteworthy extent of these patients require narcotics however, after the transient starting help with discomfort, ordinarily experience fundamental medication related reactions

and reliance, which regularly lead to treatment interference and agony backslide. So as to defeat the disadvantages of fundamental pharmacological treatment, need to create elective system for curing the tumors. Nanotechnology permits the formation of materials at a nano scale which can be changed in like manner for the natural functions. Inorganic nanoparticles are expanding consideration for its functions in medication, for example, sedate conveyance or malignant growth treatment [46, 47]. In such manner, zinc oxide nanoparticles (ZNP) have a place with a gathering of metal oxides, which has been accounted for to display a few natural capacities inferable from its photograph oxidizing capacity. As of late, ZNP has gotten a lot of consideration because of its anticancer characteristics in numerous disease cells [48]. The best bit of leeway of ZNP is its collaboration with the malignant growth cells. This is accounted that ZNP have a solid positive charge at ordinary or physiological circumstances which finds it to collaborate immovably with the contrarily charged cell layer bringing about higher cell take-up and higher cytotoxic impact in disease cells [49]. In a few articles ZNP has been joined with chemotherapeutic medications to the improve symbiotic impact. Yiqun Du et al. revealed the readiness of exposed ZNP and polyethylene glycol covered ZNP (PZNP) and contemplated its anticancer impact in pancreatic malignant growth cells in 2019. To be explicit, PZNP was progressively cytotoxic contrasted with that of ZNP in PANC1 malignant growth cells and further indicated that apoptosis is the primary method of cytotoxic action [50].

III. CONCLUSION

At present, PC identification depends just on the clinicopathological characteristics of the victims. Additionally, the victims experience a few strategies, for example, ultrasound scans, CT scans, biopsies, MRI scans so as to recognize the condition of pancreatic malignancy. In spite of the fact that there may be numerous investigations in detecting PC, no significant expert group suggest periodic screening for PC in victims who are at medium hazard in light of the fact that no screening test has been demonstrated to bring down the danger of casualty because of PC. The possibility of µOCT as a cellular/subcellular resolution imaging device for pancreatic illness identification, SVM based ML technique to identify PC and PEGylation of ZNP could be a viable procedure to enhance the stability at that time simultaneously its anticancer movement could be upgraded for advanced remedial reaction.

REFERENCES

[1] Cancer. Available online: https://www.who.int/cancer/en/ (accessed on 19 January 2020).
[2] T. Yamada, D. H. Alpers, A. N. Kalloo, N. Kaplowitz, C. Owyang, and D. W. Powell, “Textbook of gastroenterology, 5th edition.”
[3] Kim, V.M.; Ahuja, N. Early Detection of Pancreatic Cancer. Chin. J. Cancer Res. **2015**, 27, 321–331. [PubMed]
[4] Badger, S.A.; Brant, J.L.; Jones, C.; McClements, J.; Loughrey, M.B.; Taylor, M.A.; Diamond, T.; McKie, L.D. The role of surgery for pancreatic cancer: A 12-year review of patient outcome. Ulster Med. J. **2010**, 79, 70–75. [PubMed]
[5] W. C. R. Fund, “Pancreatic cancer statistics,” 2018. [Online]. Available: https://www.wcrf.org/dietandcancer/cancertrends/ pancreatic-cancer-statistics?fbclid=IwAR3R4-G3KzUh6sXmDCbWXIchsGYVQvXGdpqUgjxGZ90driz4p8NlmteTIXA
[6] M. Ilic and I. Ilic, “Epidemiology of pancreatic cancer,” World journal of gastroenterology, vol. 22, no. 44, pp. 9694–9705, 2016, doi:10.3748/wjg.v22.i44.9694.
[7] A. C. Society, “Pancreatic cancer risk factors,” 2016. [Online]. Available: https://www.cancer.org/cancer/pancreatic-cancer/causes-risksprevention/ risk-factors.html
[8] Scheiman JM, Hwang JH, Moayyedi P. American Gastroenterological Association technical review on the diagnosis and management of pancreatic cysts. Gastroenterology; 148: 824-48. 2015
[9] Klöppel G, Solcia E, Longnecker DS, Capella C, Sobin LH. Histological Typing of Tumours of the Exocrine Pancreas: World Health Organization International Histological Classification of Tumours. 2nd ed. New York: Springer-Verlag, 1998.
[10] Hamilton SR, Aaltonen LA, editors. Pathology and genetics of tumours of the digestive system. Vol. 2. World Health Organization Classification of Tumours. Lyon, France: IARC Press, 2000.
[11] Ioannis Karoumpalisa, Dimitrios K. Cystic lesions of the pancreas ;in Annals of Gastroenterology Christodouloub ,Greece 29, 155-161.2016
[12] Mohamed Ben Mabrouk, Farhat Waad.Hydatid Cyst of the Pancreas: A Report on Ten Cases in JOP. J Pancreas.2015.
[13] Philippe Lévy. Quelles tumeurs kystiques du pancréas ne doivent plus être suivies ? in Service de pancréatologie gastroentérologie,2010.
[14] American Society of clinical Oncology (ASCO) e most cancers.Net. Pancreatic malignancy - degrees. Https://www.Most cancers.Internet/malignant boom sorts/pancreatic-sickness/tiers. Gotten to July 13, 2018.
[15] Shaib WL, Ip A, Cardona ok, et al. Modern-day the executives of fringe resectable and privately improved unresectable pancreatic malignant increase. Oncologist.2016;21(2):178-187.

[16] Country wide most cancers Institute. Diviner malignant growth element certainties: pancreas disorder. Https://seer.Most cancers.Gov/statfacts/html/pancreas.Html. Gotten to July thirteen, 2018.
[17] L. Martin, "An overview of pancreatic cancer," 2017. [Online]. Available: https://www.webmd.com/cancer/pancreatic-cancer/digestivediseases- pancreatic-cancer
[18] D. Holmberg and U. Ahlgren, "Imaging the pancreas: from ex vivo to non-invasive technology," *Diabetologia*, vol. 51, no. 12, pp. 2148–2154, 2008.
[19] K. Kinkel, Y. Lu, M. Both, R. S. Warren, and R. F. Thoeni, "Detection of hepatic metastases from cancers of the gastrointestinal tract by using noninvasive imaging methods (us, ct, mr imaging, pet): a meta-analysis." *Radiology*, vol. 224, no. 3, pp. 748–756, 2002.
[20] V. Chaudhary and S. Bano, "Imaging of the pancreas: Recent advances," *Indian Journal of Endocrinology & Metabolism*, vol. 15, no. Suppl1, pp. S25, 2011.
[21] D. Huang, E. A. Swanson, C. P. Lin, J. S. Schuman, W. G. Stinson, W. Chang, M. R. Hee, T. Flotte, K. Gregory, and C. A. Puliafito, "Optical coherence tomography," *Science*, vol. 254, no. 5035, pp. 1178-1181, 1991.
[22] D. Cui, X. Liu, J. Zhang, X. Yu, S. Ding, Y. Luo, J. Gu, P. Shum, and L. Liu, "Dual spectrometer system with spectral compounding for 1-m optical coherence tomography in vivo," *Optics Letters*, vol. 39, no. 23, pp. 6727–6730, 2014.
[23] Xiaojun Yu*y*, Qianshan Ding*y*, Chi Hu, Ganggang Mu, Yunchao Deng, Yuemei Luo, Zhaohui Yuan, Honggang Yu, and Linbo Liu, ''Evaluating micro-optical coherence tomography (μOCT) as a feasible imaging tool for pancreatic disease diagnosis," *IEEE Journal of Selected Topics in Quantum Electronics*, Volume: 25 , Issue: 1 , Jan.-Feb. 2019.
[24] Octaviani, T.L.; Rustam, Z. Random Forest for Breast Cancer Prediction. In Proceedings of the 4th International Symposium on Current Progress in Mathematics and Sciences (ISCPMS2018), Depok, Indonesia, 30–31 October 2018.
[25] Rustam, Z.; Putri, R.A. Comparison between stochastic support vector machine (stochastic SVM) and Fuzzy Kernel Robust C-Means (FKRCM) in breast cancer classification. In Proceedings of the 4th International Symposium on Current Progress in Mathematics and Sciences (ISCPMS2018), Depok, Indonesia, 30–31 October 2018.
[26] Rustam, Z.; Hartini, S. Classification of Breast Cancer using Fast Fuzzy Clustering based on Kernel. In Proceedings of the 9th Annual Basic Science International Conference 2019 (BaSIC 2019), Malang, Indonesia, 20–21 March 2019.
[27] Fijri, A.L.; Rustam, Z. Comparison between Fuzzy Kernel C-Means and Sparse Learning Fuzzy C-Means for Breast Cancer Clustering. In Proceedings of the ICAITI 2018—1st International Conference on Applied Information Technology and Innovation: Toward A New Paradigm for the Design of Assistive Technology in Smart Home Care, Padang, Indonesia, 4–5 September 2018.
[28] Rustam, Z.; Hapsari, V.A.W.; Solihin, M.R. Optimal cervical cancer classification using Gauss-Newton representation based algorithm. In Proceedings of the 4th International Symposium on Current Progress in Mathematics and Sciences (ISCPMS2018), Depok, Indonesia, 30–31 October 2018.
[29] Zahras, D.; Rustam, Z. Cervical Cancer Risk Classification Based on Deep Convolutional Neural Network. In Proceedings of the ICAITI 2018—1st International Conference on Applied Information Technology and Innovation: Toward A New Paradigm for the Design of Assistive Technology in Smart Home Care, Padang, Indonesia, 4–5 September 2018.
[30] Arfiani, A.; Rustam, Z. Ovarian cancer data classification using bagging and random forest. In Proceedings of the 4th International Symposium on Current Progress in Mathematics and Sciences (ISCPMS2018), Depok, Indonesia, 30–31 October 2018.
[31] Octaviani, T.L.; Rustam, Z.; Siswantining, T. Ovarian Cancer Classification using Bayesian Logistic Regression. In Proceedings of the 9th Annual Basic Science International Conference 2019 (BaSIC 2019), Malang, Indonesia, 20–21 March 2019.
[32] Salmi, N.; Rustam, Z. Naïve Bayes Classifier Models for Predicting the Colon Cancer. In Proceedings of the 9th Annual Basic Science International Conference 2019 (BaSIC 2019), Malang, Indonesia, 20–21 March 2019.
[33] Huljanah, M.; Rustam, Z.; Utama, S.; Siswantining, T. Feature Selection using Random Forest Classifier for Predicting Prostate Cancer. In Proceedings of the 9th Annual Basic Science International Conference 2019 (BaSIC 2019), Malang, Indonesia, 20–21 March 2019.
[34] Rustam, Z.; Kharis, S.A.A. Comparison of Support Vector Machine Recursive Feature Elimination and Kernel Function as feature selection using Support Vector Machine for lung cancer classification. In Proceedings of the Basic and Applied Sciences Interdisciplinary Conference, Depok, Indonesia, 18–19 August 2017.
[35] Chao Li, PhD1, Xiaozhu Lin.Computer-Aided Diagnosis for Distinguishing Pancreatic Mucinous Cystic Neoplasms From Serous Oligocystic Adenomas in Spectral CT Images,in Technology in Cancer Research & Treatment,2016.
[36] J.Surendiran, Mohammad Jabirullah.Computer Aided Diagnosis for Detection of Lesions in Pancreas,in International Journal of Pure and Applied Mathematics.2018.
[37] Hongwei Li1, Kanru Lin.Differential Diagnosis for Pancreatic Cysts in CT Scans Using Densely-Connected Convolutional Networks,in Department of Computer Science.2018

[38] Sarfaraz.H, Pujan.K .Deep-Multi-Modal Classification of Intraductal Papillary Mucinous Neoplasms (IPMN) with Canonical Correlation Analysis;in Center for Research in Computer Vision (CRCV), University of Central Florid,2018.
[39] A. Ashcroft, "An introduction to mass spectrometry," n.d. [Online]. Available: http://www.astbury.leeds.ac.uk/facil/MStut/mstutorial.htm
[40] Emmanuel Briones, Angelyn Lao, Geoffrey A. Solano, "A Pancreatic Cancer Detection Support Tool Using Mass Spectrometry Data and Support Vector Machines", International Conference on Artificial Intelligence and Signal Processing, 2020.
[41] O. Toshiyuki et al. "Abdominal multi-organ segmentation of CT images based on hierarchical spatial modeling of organ interrelations" in *International MICCAI Workshop on Computational and Clinical Challenges in Adominal Imaging*, Springer-Verlag, 2011, pp.173- 180.
[42] Shangqing liu, Xinrui yuan, Runyue hu, Shujun liang, Shaohua feng, Yuhua ai, Yu zhang, "Automatic Pancreas Segmentation via Coarse Location and Ensemble Learning", IEEE Access, Volume: 8, pp.2906 – 2914, December 2019.
[43] Li, D., Xie, K., Wolff, R., *et al.*: 'Pancreatic cancer', *Lancet*, 2004, 363, pp.1049–1057
[44] Ruttala, H.B., Ramasamy, T., Madeshwaran, T., *et al.*: ''Emerging potential of stimulus-responsive nanosized anticancer drug delivery systems for systemic applications', *Arch. Pharm. Res.*, 2018, 41, pp. 111–129
[45] Ryan D, Hong T, Bardeesy N. Pancreatic adenocarcinoma. NEJM 2014;371:1039e49.
[46] Ramasamy, T., Ruttala, H.B., Gupta, B., *et al.*: 'Smart chemistry-based nanosized drug delivery systems for systemic applications: a comprehensive review', *J. Control Release*, 2017, 258, pp. 226–253
[47] Ramasamy, T., Ruttala, H.B., Sundaramoorthy, P., *et al.*: 'Multimodal selenium nanoshell-capped Au@mSiO2 nanoplatform for NIR-responsive chemo-photothermal therapy against metastatic breast cancer', *NPG Asia Mater.*, 2018, 10, pp. 197–216
[48] Zhang, H., Chen, B., Jiang, H., *et al.*: 'A strategy for ZnO nanorod mediated multi-mode cancer treatment', *Biomaterials*, 2011, 32, pp. 1906–1914
[49] Hanley, C., Layne, J., Punnoose, A., *et al.*: 'Preferential killing of cancer cells and activated human T cells using ZnO nanoparticles', *Nanotechnology*, 2008, 19, p. 295103
[50] Yiqun Du, Jian Zhang, Shiyan Yan,et al.: "PEGylated zinc oxide nanoparticles induce
apoptosis in pancreatic cancer cells through reactive oxygen species," *IET Nanobiotechnol.*, 2019, Vol. 13 Iss. 5, pp. 80-84