Supplementary Materials

Supplementary Table 1. Search strategy in PubMed

Search	Query	Results
#3	#1 AND #2	**1,062**
#2	"Digestive System Surgical Procedures"[Mesh] OR "Bariatric Surgery"[Mesh] OR "Laparotomy"[Mesh] OR "Roux-en-Y"[Tiab] OR "Cholecystostom*"[Tiab] OR "Choledochostom*"[Tiab] OR "Gastroenterostom*"[Tiab] OR "Jejunoileal Bypass*"[Tiab] OR "Pancreaticojejunostom*"[Tiab] OR "Peritoneovenous Shunt"[Tiab] OR "Portoenterostom*"[Tiab] OR "Gastric Bypass*"[Tiab] OR "Appendectom*"[Tiab] OR "Cholecystectom*"[Tiab] OR "Sphincterotom*"[Tiab] OR "Colectom*"[Tiab] OR "Cecostom*"[Tiab] OR "Colostom*"[Tiab] OR "Duodenostom*"[Tiab] OR "Ileostom*"[Tiab] OR "Jejunostom*"[Tiab] OR "Esophagectom*"[Tiab] OR "Hemorrhoidectom*"[Tiab] OR "Hepatectom*"[Tiab] OR "Liver Transplant*"[Tiab] OR "Pancreas Transplant*"[Tiab] OR "Pancreatectom*"[Tiab] OR "Pancreaticoduodenectom*"[Tiab] OR "Proctectom*"[Tiab] OR "gastrectom*"[tiab] OR "Gastrostom*"[tiab] OR "Esophagoplast*"[tiab] OR "Esophagostom*"[tiab] OR "Hepatectom*"[tiab]	**489,138**
#1	"Machine Learning"[Mesh] OR "Machine Learning"[Tiab] OR "machine intelligen*"[tiab] OR "machine vision*"[tiab] OR "machine learning"[tiab] OR "transfer learning"[tiab] OR "deep learning"[tiab] OR "neural network*"[tiab] OR "support vector machine*"[tiab] OR "automatic segmentation*"[tiab] OR "Long short term memory"[tiab] OR "LSTM"[tiab] OR "supervised learning"[tiab] OR "unsupervised learning"[tiab] OR "reinforcement learning*"[tiab] OR "hierarchical learning*" [tiab] OR "Image Interpretation*"[tiab] OR "Prediction model*"[tiab] OR "image recognition"[tiab] OR "perceptron"[tiab]	**154,754**

Supplementary Table 2. Search strategy in Embase.com

Search	Query	Results
#5	#3 NOT #4	**1227**
#4	#3 AND ('chapter'/it OR 'conference abstract'/it OR 'conference paper'/it OR 'conference review'/it OR 'editorial'/it OR 'erratum'/it OR 'letter'/it OR 'note'/it OR 'short survey'/it OR 'tombstone'/it)	**857**
#3	#1 AND #2	**2084**
#2	'gastrointestinal surgery'/exp OR 'laparotomy'/exp OR 'biliary tract surgery'/exp OR (‘Roux-en-Y’ OR ‘Cholecystostom*’ OR ‘Choledochostom*’ OR ‘Gastroenterostom*’ OR ‘Jejunoileal Bypass*’ OR ‘Pancreaticojejunostom*’ OR ‘Peritoneovenous Shunt’ OR ‘Portoenterostom*’ OR ‘Gastric Bypass*’ OR ‘Appendectom*’ OR ‘Cholecystectom*’ OR ‘Sphincterotom*’ OR ‘Colectom*’ OR ‘Cecostom*’ OR ‘Colostom*’ OR ‘Duodenostom*’ OR ‘Ileostom*’ OR ‘Jejunostom*’ OR ‘Esophagectom*’ OR ‘Hemorrhoidectom*’ OR ‘Hepatectom*’ OR ‘Liver Transplant*’ OR ‘Pancreas Transplant*’ OR ‘Pancreatectom*’ OR ‘Pancreaticoduodenectom*’ OR ‘Proctectom*’ OR ‘gastrectom*’ OR ‘Gastrostom*’ OR ‘Esophagoplast*’ OR ‘Esophagostom*’ OR ‘Hepatectom*’):ti,ab,kw	**720,511**
#1	'machine learning'/exp OR (‘Machine Learning’ OR ‘machine intelligen*’ OR ‘machine vision*’ OR ‘machine learning’ OR ‘transfer learning’ OR ‘deep learning’ OR ‘neural network*’ OR ‘support vector machine*’ OR ‘automatic segmentation*’ OR ‘Long short term memory’ OR ‘LSTM’ OR ‘supervised learning’ OR ‘unsupervised learning’ OR ‘reinforcement learning*’ OR ‘hierarchical learning*’ OR ‘Image Interpretation*’ OR ‘Prediction model*’ OR ‘image recognition’ OR ‘perceptron’):ti,ab,kw	335,846

Supplementary Table 3. Search strategy in Clarivate Analytics/Web of Science Core Collection

Search	Query	Results
#4	#1 AND #2 Refined by: [excluding] DOCUMENT TYPES: (LETTER OR MEETING ABSTRACT OR EDITORIAL MATERIAL OR CORRECTION)	**667**
#3	#1 AND #2	**747**
#2	TS=("Roux-en-Y" OR "Cholecystostom*" OR "Choledochostom*" OR "Gastroenterostom*" OR "Jejunoileal Bypass*" OR "Pancreaticojejunostom*" OR "Peritoneovenous Shunt" OR "Portoenterostom*" OR "Gastric Bypass*" OR "Appendectom*" OR "Cholecystectom*" OR "Sphincterotom*" OR "Colectom*" OR "Cecostom*" OR "Colostom*" OR "Duodenostom*" OR "Ileostom*" OR "Jejunostom*" OR "Esophagectom*" OR "Hemorrhoidectom*" OR "Hepatectom*" OR "Liver Transplant*" OR "Pancreas Transplant*" OR "Pancreatectom*" OR "Pancreaticoduodenectom*" OR "Proctectom*" OR “gastrectom*” OR “Gastrostom*” OR “Esophagoplast*” OR “Esophagostom*” OR “Hepatectom*”)	**294,577**
#1	TS=("Machine Learning" OR “machine intelligen*” OR “machine vision*” OR “machine learning” OR “transfer learning” OR “deep learning” OR “neural network*” OR “support vector machine*” OR “automatic segmentation*” OR “Long short term memory” OR “LSTM” OR “supervised learning” OR “unsupervised learning” OR “reinforcement learning*” OR “hierarchical learning*” OR “Image Interpretation*” OR “Prediction model*” OR “image recognition” OR “perceptron”)	**477,557**

Supplementary Table 4. Search strategy in Wiley/Cochrane Library

Search	Query	Results
#3	#1 AND #2	**7**
#2	("Roux en Y" OR "Cholecystostom*" OR "Choledochostom*" OR "Gastroenterostom*" OR "Jejunoileal Bypass*" OR "Pancreaticojejunostom*" OR "Peritoneovenous Shunt" OR "Portoenterostom*" OR "Gastric Bypass*" OR "Appendectom*" OR "Cholecystectom*" OR "Sphincterotom*" OR "Colectom*" OR "Cecostom*" OR "Colostom*" OR "Duodenostom*" OR "Ileostom*" OR "Jejunostom*" OR "Esophagectom*" OR "Hemorrhoidectom*" OR "Hepatectom*" OR "Liver Transplant*" OR "Pancreas Transplant*" OR "Pancreatectom*" OR "Pancreaticoduodenectom*" OR "Proctectom*" OR “gastrectom*” OR “Gastrostom*” OR “Esophagoplast*” OR “Esophagostom*” OR “Hepatectom*”):ti,ab,kw	**4,113**
#1	("Machine Learning" OR “machine intelligen*” OR “machine vision*” OR “machine learning” OR “transfer learning” OR “deep learning” OR “neural network*” OR “support vector machine*” OR “automatic segmentation*” OR “Long short term memory” OR “LSTM” OR “supervised learning” OR “unsupervised learning” OR “reinforcement learning*” OR “hierarchical learning*” OR “Image Interpretation*” OR “Prediction model*” OR “image recognition” OR “perceptron”):ti,ab,kw	**4,733**

Supplementary Table 5. General characteristics of liver surgery studies

Authors	Year	Country	Patients	Age (mean)	Study design	Pathology	Surgical procedures	Type of machine learning	External validation	ML purpose	Study outcomes	Predictive performance (ACC/AUC)
Mai *et al.*[22]	2021	China	903	-	Retrospective Cohort	HCC	Hepatectomy	Neural Networks	No	Predict early recurrence of HCC	AUC	-/0.74
Chong *et al.*[23]	2021	China	323	55	Retrospective Cohort	HCC	Hepatectomy	Radiomics	No	Predict early recurrence of HCC	AUC	-/0.84
Ning *et al.*[24]	2020	China	325	53	Retrospective Cohort	HCC	Hepatectomy	Radiomics	No	Predict early recurrence of HCC	AUC	-/0.74
Shan *et al.*[25]	2019	China	146	54	Retrospective Cohort	HCC	Hepatectomy	Radiomics	No	Predict early recurrence of HCC	AUC	-/0.79
Wang *et al.*[26]	2020	China	167	-	Retrospective Cohort	HCC	Hepatectomy	Radiomics	No	Predict early recurrence of HCC	ACC; AUC	0.79/0.83
Ji *et al.*[27]	2019	China	470	-	Retrospective	HCC	Hepatectomy	Radiomics	Yes	Predict recurrence	C-Index	NA

					Cohort					of HCC		
Qin *et al.*[28]	2021	China	274	58	Retrospective Cohort	PHC	Hemihepatectomy	Radiomics	Yes	Predict early recurrence in PHC	ACC; AUC	0.76/0.86
Schoenberg *et al.*[29]	2020	Germany	181	66	Prospective Cohort	HCC	Hepatectomy	Random Forest	No	Predict disease-free survival after hepatectomy	AUC	-/0.77
Chiu *et al.*[30]	2013	Taiwan	434	58	Retrospective Cohort	HCC	Hepatectomy	Neural Networks	No	Predict survival after hepatectomy	ACC; AUC	0.99/0.98
Qiao *et al.*[31]	2014	China	725	51	Prospective Cohort	HCC	Hepatectomy	Neural Networks	Yes	Predict postoperative overall survival	AUC	-/0.83
Spelt *et al.*[32]	2013	Sweden	241	66	Retrospective Cohort	CRLM	Hepatectomy	Neural Networks	No	Predict postoperative survival	C-index	NA
Ho *et al.*[33]	2012	Taiwan	482	58	Retrospective Cohort	HCC	Hepatectomy	Multiple Machine Learning	No	Predict postoperative disease-free survival	AUC	NA
Dong *et al.*[34]	2020	China	322	58	Retrospective	HCC	Hepatectomy	Radiomics	No	Predict microvascu	AUC	0.73/0.81

					Cohort					lar invasion		
Feng *et al.*[35]	2019	China	160	55	Retrospective Cohort	HCC	Hepatectomy	Radiomics	No	Predict microvascular invasion	AUC	-/0.83
Song *et al.*[36]	2021	China	601	57	Retrospective Cohort	HCC	Hepatectomy	Multiple Machine Learning	No	Predict microvascular invasion	ACC; AUC	NA
Zhou *et al.*[37]	2021	China	114	53	Retrospective Cohort	HCC	Hepatectomy	Multiple Machine Learning	No	Predict microvascular invasion	ACC; AUC	NA
Mao *et al.*[38]	2021	China	114	59	Retrospective Cohort	HCC; ICC; Metastatic Liver Cancer	Hepatectomy	Multiple Machine Learning	No	Differentiate between primary and metastatic liver cancer	ACC; AUC	NA
Yao *et al.*[39]	2020	China	110	57	Retrospective Cohort	ECC	Hepatectomy	Multiple Machine Learning	No	Predict differentiation and lymph node metastasis in ECC	ACC; AUC	NA
Sahara *et al.*[40]	2021	USA	63507	63	Retrospective Cohort	Not Specified	Hepatectomy & Pancreatectomy	Decision Tree	No	Predict mortality after hepatopancreatic surgery	AUC	-/0.81
Hamamoto *et al.*[41]	1995	Japan	11	62	Retrospective Cohort	HCC	Hepatectomy	Neural Networks	No	Predict discharge or hepatic	ACC	0.96/-

										dysfunction of HCC patients		
Zhu *et al.*[42]	2021	China	180	56	Retrospective Cohort	CRLM	Hepatectomy	Neural Networks	Yes	Predict chemo response of CRLM	ACC; AUC	0.89/0.83
Chen *et al.*[43]	2021	China	144	52	Retrospective Cohort	HCC	Hepatectomy	Radiomics	Yes	Predict postoperative liver failure	ACC; AUC	0.73/0.80
Zhu *et al.*[44]	2020	China	101	55	Retrospective Cohort	HCC	Hepatectomy	Radiomics	No	Predict postoperative liver failure	ACC; AUC	0.80/0.89
Mai *et al.*[45]	2020	China	353	48	Retrospective Cohort	HCC	Hemihepatectomy	Neural Networks	No	Predict postoperative liver failure	AUC	-/0.88
Mai *et al.*[46]	2020	China	1152	49	Retrospective Cohort	HCC	Hepatectomy	Neural Networks	No	Predict postoperative liver cirrhosis	AUC	-/0.77
Kato *et al.*[47]	2007	Japan	60	-	Retrospective Cohort	HCC; ICC	Hepatectomy	Radiomics	No	Predict postoperative liver fibrosis	AUC	-/0.72
Zhang *et al.*[48]	2021	China	88	50	Retrospective Cohort	HCC	Hepatectomy	Multiple Machine Learning	No	Predict postoperative liver	ACC; AUC	NA

										generation		
Merath *et al.*[49]	2020	USA	15657	66	Retrospective Cohort	Not Specified	Hepatectomy & Pancreatectomy& Colectomy	Decision Tree	No	Predict postoperative complications	C-index	NA
Lei *et al.*[50]	2020	China	1173	56	Retrospective Cohort	Not Specified	Hepatectomy	Multiple Machine Learning	No	Predict postoperative acute kidney insufficiency	ACC; AUC	NA
Tsilimigras *et al.*[51]	2020	USA	976	67	Retrospective Cohort	HCC	Hepatectomy	Decision Tree	No	Determine predictors for HCC survival	-	-
Tsilimigras *et al.*[52]	2020	USA	1146	60	Retrospective Cohort	ICC	Hepatectomy	Decision Tree	No	Determine predictors for ICC survival	-	-
Moro *et al.*[53]	2020	USA	1123	61	Retrospective Cohort	CRLM	Hepatectomy	Decision Tree	No	Determine prognostic factors for KRAS CRLM	-	-
Tsilimigras *et al.*[54]	2020	USA	826	58	Retrospective Cohort	ICC	Hepatectomy	Decision Tree	No	Predict clusters of prognosis for ICC patients	-	-

Bagante *et al.*[55]	2019	USA	1116	-	Retrospective Cohort	ICC	Hepatectomy	Decision Tree	No	Predict clusters of prognosis for ICC patients	-	-

ACC: Accuracy; AUC: area under the curve; NA: not applicable.

Supplementary Table 6. General characteristics of biliary surgery studies

Authors	Year	Country	Patients	Age (mean)	Study design	Pathology	Surgical procedures	Type of Machine Learning	External validation	ML purpose	Study outcomes	Predictive performance (ACC/AUC)
Gholipour *et al.*[56]	2009	Iran	893	49	Retrospective Cohort	Acute Cholecystitis	Laparoscopic & Open Cholecystectomy	Neural Networks	No	Predict conversion to open cholecystectomy	NA	NA
Eldar *et al.*[57]	2002	Israel	225	54	Retrospective Cohort	Acute Cholecystitis	Laparoscopic & Open Cholecystectomy	Neural Networks	No	Determine predictors for conversion to open cholecystectomy	ACC	0.89/-
Bouarfa *et al.*[58]	2011	Germany	337	-	Retrospective	Not Specified	Laparoscopic	SVM	No	Predict intraoperati	ACC	0.83/-

					Cohort		Cholecystectomy			ve complexity		
Liew *et al.*[59]	2007	Taiwan	117	35	Retrospective Cohort	Acute Cholecystitis; Gallstones; Cholesterolosis; Cholesterol Polyp	Cholecystectomy	Neural Networks	No	Predict gallstone disease diagnosis	ACC	0.97/-
Vukicevic *et al.*[60]	2016	Serbia	303	57	Retrospective Cohort	Acute Cholecystitis; Gallstones	Choledochotomy	Multiple Machine Learning	No	Predict common bile duct stones	ACC; AUC	NA
Shi *et al.*[61]	2012	Taiwan	400	56	Prospective Cohort	Acute Cholecystitis; Gallstones	Laparoscopic Cholecystectomy	Multiple Machine Learning	No	Predict postoperative quality of life	Mean absolute percentage error	NA

ACC: Accuracy; AUC: area under the curve; NA: not applicable.

Supplementary Table 7. General characteristics of pancreatic surgery studies

Authors	Year	Country	Patients	Age (mean)	Study design	Pathology	Surgical procedures	Type of Machine Learning	External validation	ML purpose	Study outcomes	Predictive performance (ACC/AUC)
Velez-Serrano *et al.*[62]	2017	Spain	4088	64	Retrospective Cohort	Pancreas Carcinoma	Pancreatectomy & Pancreaticoduodenectomy	Gradient Boosting	No	Predict postoperative mortality	AUC	-/0.92
Mofidi *et al.*[63]	2007	UK	664	56	Retrospective Cohort	Acute Pancreatitis	-	Neural Networks	Yes	Prediction of disease severity and mortality	ACC	0.95/-
Ansari *et al.*[64]	2013	Sweden	84	66	Retrospective Cohort	Pancreas Carcinoma	Pancreatectomy	Neural Networks	No	Predict postoperative survival	C-index	NA
Walczak *et al.*[65]	2017	USA	219	64	Prospective Cohort	Pancreas Carcinoma	Pancreatectomy	Neural Networks	No	Predict postoperative survival	ACC	0.71/-
Elarre *et al.*[66]	2019	Spain	40	63	Retrospective Cohort	Pancreas Carcinoma	Pancreatectomy	Multiple Machine Learning	Yes	Predict early recurrence	ACC; AUC	NA
Mu *et al.*[67]	2020	China	513	59	Retrospective Cohort	Postoperative Pancreatic Fistula	Pancreaticoduodenectomy	Neural Networks	Yes	Predict postoperative pancreatic	ACC; AUC	0.77/0.81

										fistulas		
Lin *et al.*[68]	2021	China	325	60	Retrospective Cohort	Postoperative Pancreatic Fistula	Pancreaticoduodenectomy	Radiomics	No	Predict postoperative pancreatic fistulas	ACC; AUC	0.75/0.85
Han *et al.*[69]	2020	Korea	1769	68	Retrospective Cohort	Postoperative Pancreatic Fistula	Pancreaticoduodenectomy	Multiple Machine Learning	No	Predict postoperative pancreatic fistulas	AUC	NA
Skawran *et al.*[70]	2021	Switserland	62	69	Retrospective Cohort	Postoperative Pancreatic Fistula	Pancreaticoduodenectomy	Multiple Machine Learning	No	Predict postoperative pancreatic fistulas	AUC	NA
Cos *et al.*[71]	2021	USA	48	63	Prospective Cohort	Pancreas Carcinoma	Pancreatectomy & Pancreaticoduodenectomy	Multiple Machine Learning	No	Predict postoperative complications	AUC	NA
Kuwahara *et al.*[72]	2019	Japan	50	70	Retrospective Cohort	IPMN	Pancreatectomy	Neural Networks	No	Predict malign IPMN	ACC; AUC	0.94/0.98
Attiyeh *et al.*[73]	2019	USA	103	67	Retrospective Cohort	IPMN	Pancreatectomy & Pancreaticoduodenectomy	Radiomics	No	Differentiate between dysplasia and carcinoma	ACC; AUC	0.80/0.79

ACC: Accuracy; AUC: area under the curve; NA: not applicable.