

M E D E S - IGL

MEdical DEcision Shell.

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Reference Manual

(Update 2009)

Version 3. 1 for Windows

1. Introduction

In many fields of Medicine, Pathology and Neuropathology, the literature contains rich information about the relative frequencies and the morphological, immunohistological and other clinical features of different diagnoses. However, it is difficult to apply this information, often consisting of dozens or even hundreds of numbers, to the concrete problem of giving the differential diagnosis of a new case. Another difficult problem is to select from the vast amount of expensive antibodies for immunohistological studies only those that are necessary to obtain a differential diagnosis.

MEDES-IGL (see attachment "IndexFinal") is a decision making computer program that helps to solve these problems. It works with both discrete and continuous numerical values (laboratory data). MEDES-IGL automatically selects the best symptom, morphological or histochemical characteristic, or laboratory test that best discriminates between the possible diagnoses. After receiving information about the presence or absence of this symptom or characteristic, or about the numerical result of the test, MEDES-IGL updates the likelihood of each diagnose. Likelihoods are represented as numerical probabilities.

In most cases the final decision is reached long before all possible questions have been asked. MEDES-IGL is able to deduce that, whatever the answers to these questions, they will not affect the final outcome.

MEDES provides a non-programmers interface shell developed specially for the medical diagnosis after more than 20 years of experiences with expert systems in the Free University Berlin and in Katharinenhospital-Stuttgart. The Programs TUMOR, CT, NEURO, LIQUOR etc. were developed for us with the help a Bayesian Discriminant Analysis and artificial intelligence methods [3, 4, 7-17]. MEDES is a modified BBN Algorithm (Bayesian Belief Network-Algorithm) published by Pearl [21] and Morawaski [18, 19] and analyzed by Bartels et al.[1, 2]. BBN have a dynamic range and numeric response characteristics that make it uniquely suitable for descriptive classification schemes [5, 6]. Features showing considerable overlap of tolerance regions may be used to derive classification decisions. MEDES works with discrete and continuous numerical values (laboratory data). This program

Quantitative diagnostic assessments in histopathology frequently must deal with uncertain information and vague linguistic terms. Final decisions are rarely based on the evaluation of a single diagnostic clue; rather, multiple pieces of evidence are routinely observed, and the certainty of combined evidence in support of a final diagnostic decision must be determined Bartels et al. [1, 2].

MEDES is practical and easy to use. You need only two data files: DP matrix (Diagnostic Frequency matrix) and CP matrices (Frequencies of symptoms for discrete data, and Mean and Standard deviation for numerical data) based on the frequency of the diagnosis and symptoms, laboratory values and morphological clues observed or obtained from literature. Examples of these matrices can be found in the **data files** of the Addendum.. (ASCII-Files to be read with a Tex-editor or with the module "**create Diagnosis and Symptoms files**").

MEDES selects the best symptom, laboratory values or morphological characteristics for the differentiation of similar diagnoses and links dynamically the appropriate nodes throughout the belief network until the final numerical decision. Only in a few cases are all nodes of the BBN necessary.

Our experiences with MEDES have been positive when in applied to histopathological and clinical diagnoses, and diagnoses based on morphometric values. MEDES is also an excellent tool to help medical students learn the decision making process.

2. System Requirements

Windows 98,2000,ME,XP.

3. Installation:

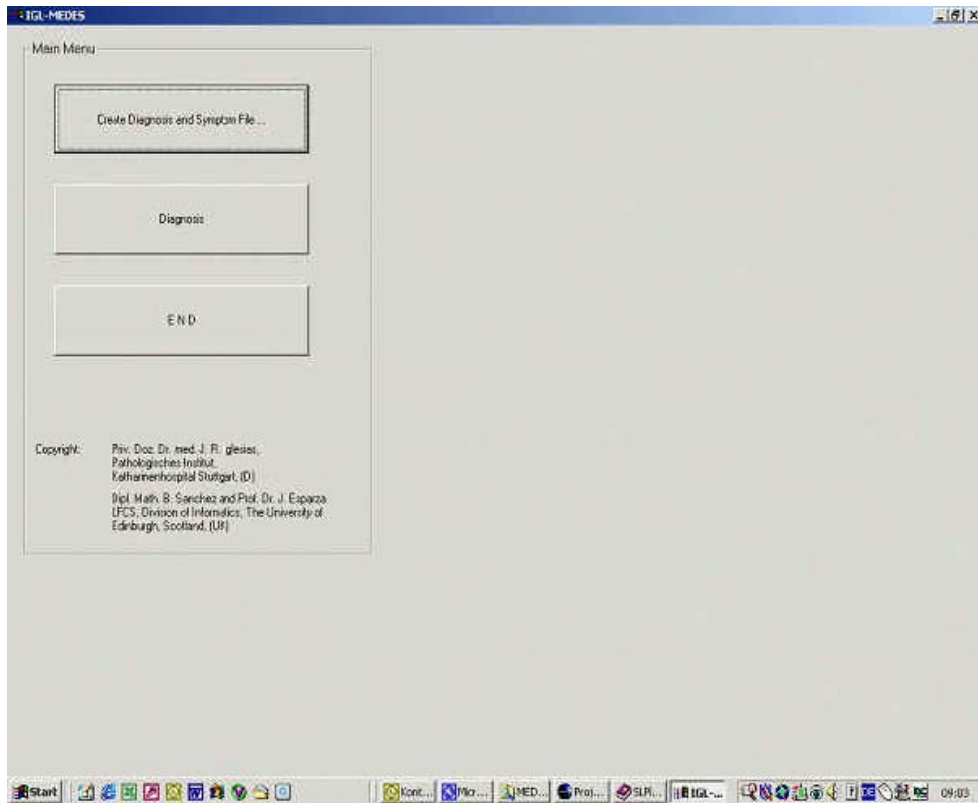
To install MEDES,

3.1. Make a directory with the name MEDES-IGL or similar.

3.2. Copy the files of the diskette into directory MEDES-IGL and click Setup

4. Run MEDES-IGL

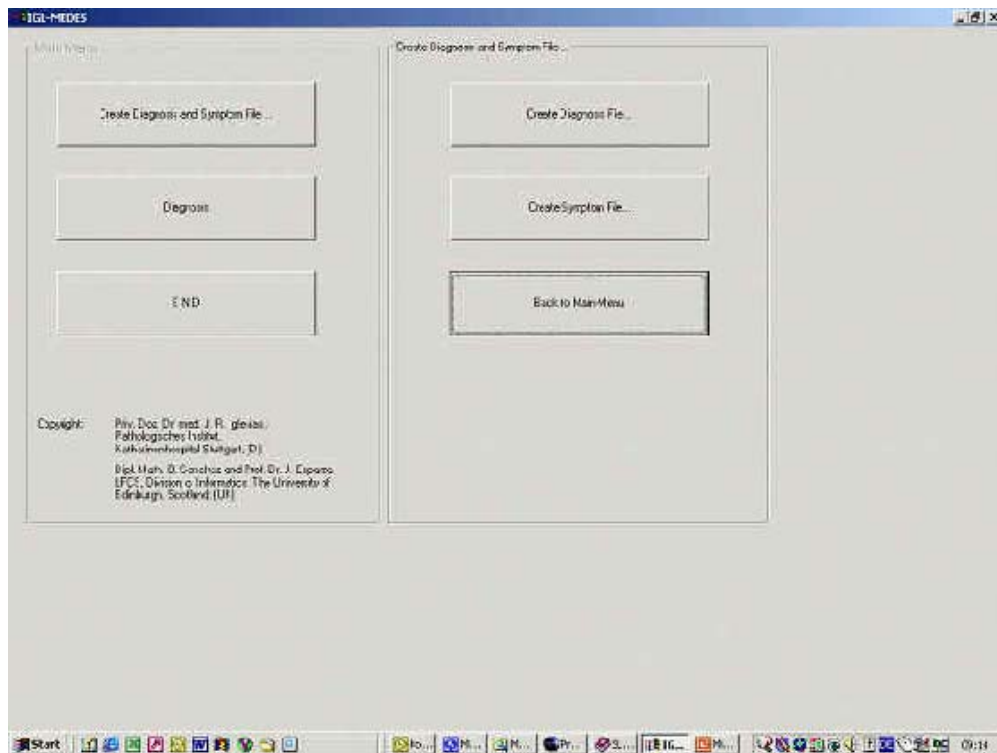
After the installation this will cause the following screen to be displayed.



The screen is divided into the following three general categories:

- * **Create Diagnosis and Symptoms File:** to create new Diagnosis and Symptoms files.
- * **Diagnosis:** to run created files.
- * **End:** to finish the session.

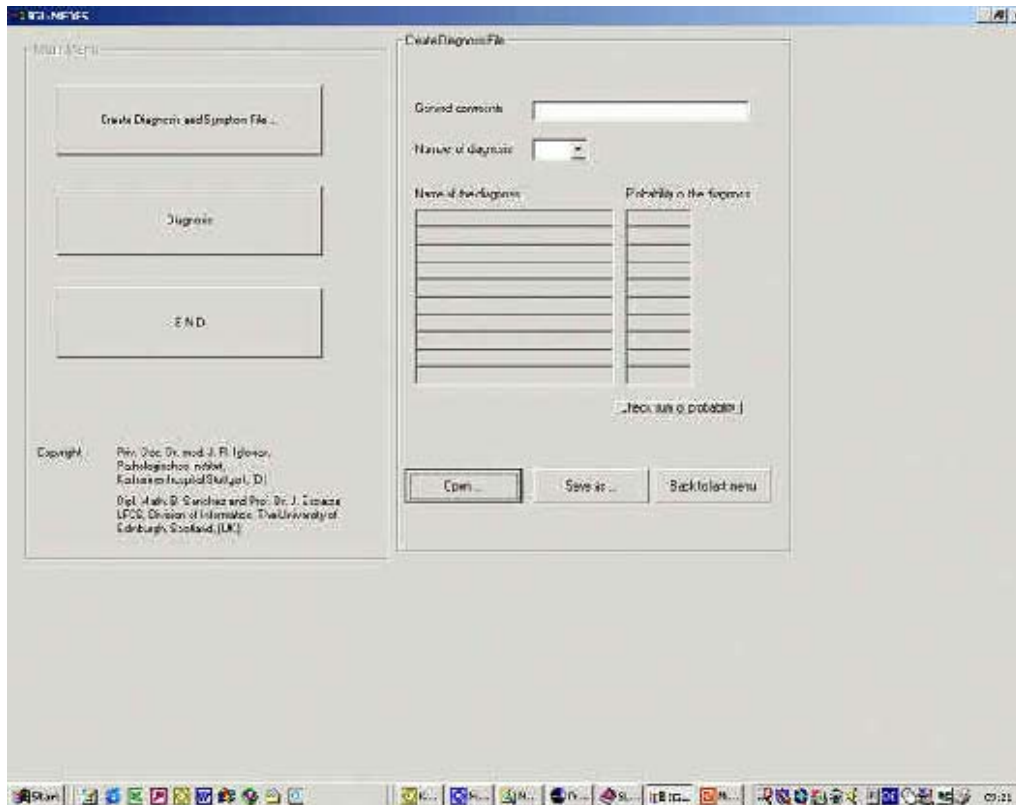
Selecting **Create Diagnosis and Symptoms File** brings up the following display.



The right screen is divided into three subcategories

- * **Create a Diagnosis File**
- * **Create a Symptom File**
- * **Back to Main Menu**

Selecting **Create Diagnosis File** brings up the following display.



The settings shown a right display divided into eight panels.

The first panel located at the top right side of the screen sets for **general comments** about the diagnoses to run.

The user may specify a number of diagnoses into the text box located immediately under the comments. After the tipping of number of diagnoses the user may specify the names of the diagnoses and their correspondent frequencies (divided to 100). The sum of the probabilities (frequencies) will be automatically checked. If the real frequencies are not known, the frequency is the number of the diagnoses divided to 1

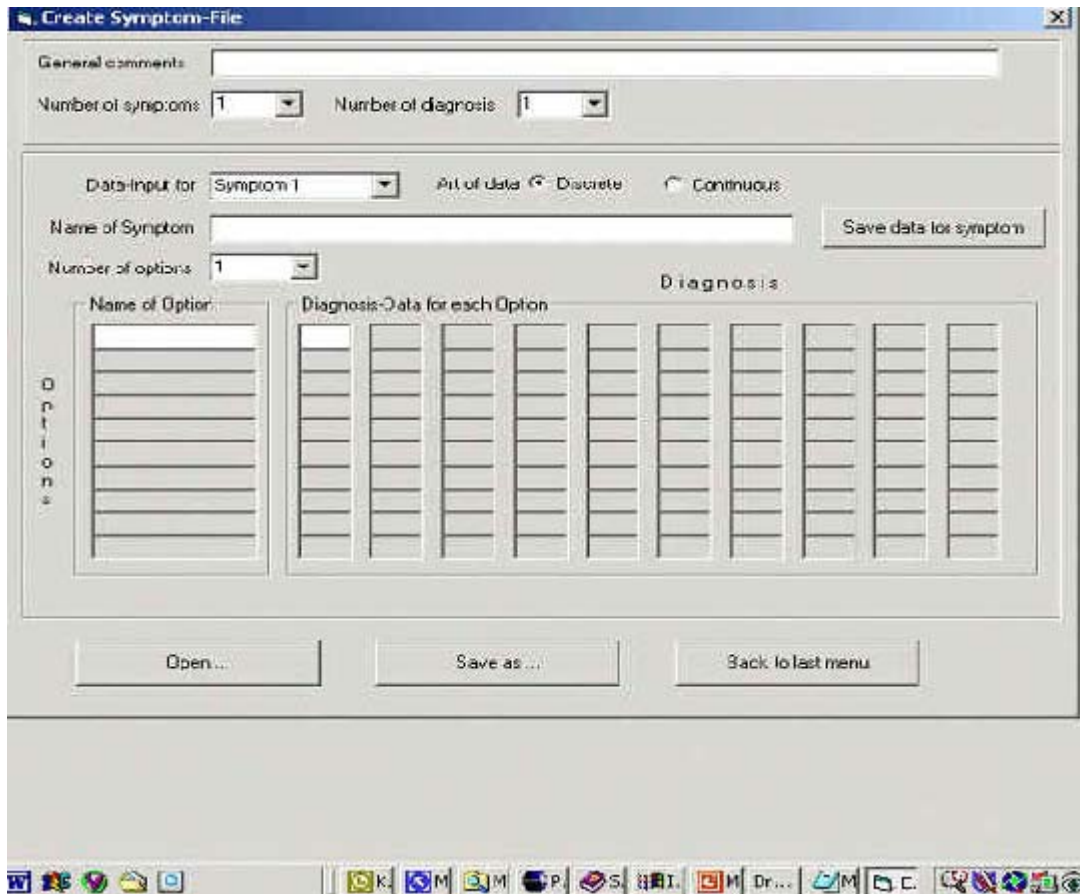
Example: Melanoma versus Adenocarcinoma NOS

Number of diagnoses 2

1 Melanoma	0.50	(use the '.' for decimal !!)
2 Adenocarcinoma NOS	0.50	
Sum		1

Then the user may typing **Save as..** and save the file with a name (xxxxxxx.dia) into the correspondent directory.

After that the user may typing "**Back to last menu**" and "**Create symptom File**". The settings shown the following screen.



The first panel located at the top right side of the screen sets for **general comments** about the symptoms to run.

The user may specify the number of the symptoms and the number of the diagnoses into the text box located immediately under the comments. After that the user may specify the names of the symptoms their options and their correspondent frequencies (divided to 100). The sum of the probabilities (frequencies) will be **1** by discrete data. For continuous values the user may specify the measurement unit, the mean value and standard deviation for each diagnosis. For each symptom the user should be typing "**Save data for symptoms**".

Example:

Name the Symptom 1 : Osteonectin

Art the data : discrete

Options 2

Positive	.99	.01
Negative	.01	.99

Name the Symptom 2 : 2 CD146 2

Art the data : discrete

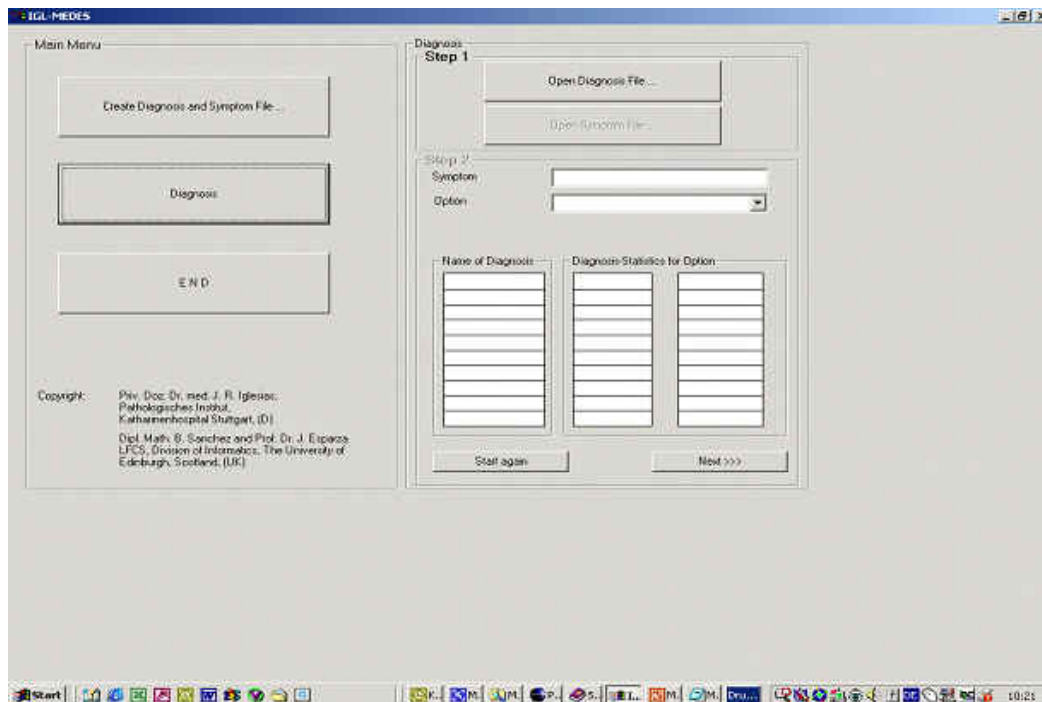
Options 2

Positive .99 .01
 Negative .01 .99

etc.....

At the end the user may typing "**Save as...**" an save the file with a name (xxxxxxx.sym) into the correspondent directory. Finally by clicking "**Back to last menu**" and by clicking "**Back to Main-menu**" is possible to run the program "**Diagnosis**".

The settings shown the following screen.



Sept 1: The user may typing **Open Diagnosis File** and **Open Symptom File**.

Step 2: The user may be chose the different options by clicking on the box "**Option**" until the final diagnosis are show.

Remember to change of the directory to run different programs.

All the files of the diagnoses and of the symptoms can be seen and be correct with a text editor !

5. Addendum

Examples

5.1. Bladder Adenocarcinoma Versus Lung Adenocarcinoma and Hepatocellular Carcinoma.

Diagnoses.

1 Bladder Adenocarcinoma	0.3333
2 Lung Adenocarcinoma	0.3333
3 Hepatocellular Carcinoma	0.3333

Symptoms

Number of symptoms 4, Number of diagnoses 3.

1 AE1/AE3 2
 Positive
 Negative
 0.99 0.99 0.20
 0.01 0.01 0.80

2 CD15 2
 Positive
 Negative
 0.82 0.73 0.14
 0.18 0.27 0.86

3 BCL-2 2
 Positive
 Negative
 0.84 0.38 0.01
 0.16 0.62 0.99

4 CK7 2
 Positive
 Negative
 0.72 0.95 0.19
 0.28 0.05 0.81

6.2. Dey P, Gh S. Pattari SK. Nuclear Image Morphometry and Cytologic Grade of Breast Carcinoma. , Analyt Quant Cytol Histol 2000; 22:483-485 (Table 1)

Diagnoses 4

1, "Benign ", .25
 2, "Carcinoma Grade 1 ", .25
 3, "Carcinoma Grade 2 ", .25
 4, "Carcinoma Grade 3 ", .25

Symptoms (Parameter) 6, Diagnoses 4

1. Area (μm^2)
 2. SDNA

3. Convex area (μm^2)
4. Convex perimeter (μm)
5. Perimeter (μm)
6. Diameter (μm)

Table 1 Nuclear Morphometric Findings

Parameter	Benign (10 cases) (mean \pm SD)	Carcinoma grade 1 (9 cases) (mean \pm SD)	Carcinoma grade 2 (10 cases) (mean \pm SD)	Carcinoma grade 3 (5 cases) (mean \pm SD)
Area (μm^2)	34.99 \pm 5.67	55.25 \pm 10.64	75.50 \pm 24.21	76.55 \pm 29.09
SDNA	8.42 \pm 2.39	17.35 \pm 12.17	26.63 \pm 10.4	38.08 \pm 16.27
Convex area (μm^2)	37.52 \pm 6.23	58.33 \pm 11.71	83.86 \pm 28.55	84.28 \pm 31.54
Convex perimeter (μm)	21.67 \pm 1.86	27.10 \pm 2.28	31.74 \pm 5.6	31.65 \pm 5.86
Perimeter (μm)	21.72 \pm 6.82	29.48 \pm 2.55	35.08 \pm 6.8	34.63 \pm 6.40
Diameter (μm)	7.97 \pm 0.66	9.64 \pm 0.93	11.41 \pm 2.06	11.48 \pm 2.23

SDNA = standard deviation of nuclear area.

One-way ANOVA test showed: benign versus carcinoma, grades 1-3, significant ($P < 0.05$).

Carcinoma grade 1 versus 2 and 3, significant ($P < 0.01$).

"Symptoms of Breast Carcinoma"

- 6 <----- 6 symptoms
- 4 <----- 4 diagnoses
- 1, "Area ", 1, 1 <----- 1 option; 1 = continuous
- "micro-m2 "
- 34.99, 5.67 <----- mean = 34.99;
- sd = 5.67 (1° diagnosis)
- 55.25, 10.64 <----- mean = 55.22;
- sd = 10.64 (2° diagnosis)
- 75.5, 24.21 <----- mean = 75.5 ;
- sd = 24.21 (3° diagnosis)
- 76.55, 29.09 <----- mean = 76.55;
- sd = 29.09 (4° diagnosis)
- 2, "SDNA ", 1, 1
- "micro-m2 "
- 8.42, 2.39
- 17.35, 12.17
- 26.63, 10.4
- 38.01, 16.27
- 3, "Convex area ", 1, 1
- "micro-m2 "
- 37.52, 6.23
- 58.33, 11.71
- 83.86, 28.55
- 84.28, 31.54
- 4, "Convex perimeter ", 1, 1
- "micro-m2 "
- 21.67, 1.86

27.1,2.28
 31.74,5.6
 31.65,5.86
 5,"Perimeter ",1,1
 "micro-m2 "
 21.72,6.82
 29.48,2.55
 35.08,6.8
 34.63,6.4
 6,"Diameter ",1,1
 "micro-m2 "
 7.97,.66
 9.64,.93
 11.41,2.06
 11.48,2.23

 The user may typing the parameter of the Diagnosis File and of the Symptom Files with the help of a editor, without the use of the categories create a diagnosis of symptom file.

Example of the *diagnosis file* "**Bladder Adenocarcinoma Versus Lung Adenocarcinoma and Hepatocellular Carcinoma.**"

BladderLungeHepato"
 3 <----- diagnoses
 1,"BladderAdenocarcinoma ",.3333
 2,"Lungadenocarcinoam ",.3333 <----- frequencies/100
 3,"HepatocellularCarcinoma ",.3333

3 diagnoses

Example of the *symptom file* "**Bladder Adenocarcinoma Versus Lung Adenocarcinoma and Hepatocellular Carcinoma.**"

SynptommasDeBladder"
 4 <----- 4 symptoms
 3 <----- 3 diagnoses
 1,"AE1/AE3 ",2,0 <----- 2 options,0 = discrete (1= for continuous values)
 "Positive" <----- Don't forget ' ' '(quotations marks !)
 "Negative"
 .99,.99,.2 <----- frequencies /100 (',' for separations; '! for decimal !!)
 .01,.01,.88 for continuous values mean and
 standard deviation
 2,"CD15 ",2,0
 "Positive"

"Negative"
.82,.73,.14
.18,.27,.86
3,"BCL-2 ",2,0
"Positive"
"Negative"
.84,.38,.01
.16,.62,.99
4,"CK7 ",2,0
"Positive"
"Negative"
.72,.95,.19
.28,.05,.81

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Intelligent programmes for the diagnosis of tumors with the help of AI techniques:

INDEX OF HISTOLOGICAL, IMMUNOHISTOLOGICAL AND CLINICAL DIFFERENTIAL DIAGNOSIS OF TUMORS

(657 DiffDiag. January 2009)

CD available

- | | | |
|--------------------------------|--|---|
| 1. Bladder (17) | 12. Lymphomas (19) | 22. Pancreas (28) |
| 2. Breast (47) | 13. Male (25) | 23. Pediatric (10) |
| 3. Colon (25) | 14. Mediastinum (4) | 24. Peritoneum (1) |
| 4. Cytology (10) | 15. Neuroendocrine (35) | 25. Renal (18) |
| 5. Cytometry (20) | 16. Neurology (1) | 26. Salivary (6) |
| 6. Female (23) | 17. Neuropathology (106) | 27. Skin (18) |
| 7. Gastric (19) | 18. Neuroradiology (5) | 28. Soft Tissue (68) |
| 8. Grado-Histo (1) | 19. Oropharyngeal (7) | 29. Thymus (3) |
| 9. Head Neck (4) | 20. Oesophagus (5) | 30. UndiffCarcinomas (21) |
| 10. LiverBilGal (28) | 21. Osteogenic (11) | 31. Metastases probabilities (1) |
| 11. Lung (58) | | |

Neurology (1)

1. **Meningitis:** The influence of meningeal signs in the diagnosis of meningitis.

Neuropathology (107)

1. **Adrenal tumors.** Prognostic Factors in adrenal cortical tumors.
2. **AnaplasGenetic:** Prognostic of Patients with Anaplastic Gliomas According to Genetic Profile.
3. **AstroAnaGlioblasBilbao:** Differential Diagnosis of Anaplastic Astrocytomas and Glioblastomas (9 features: method of binomial Regression).
4. **AstroAnaGlioblas:** Differential Diagnosis of Anaplastic Astrocytomas and Glioblastomas (45 features).
5. **AstrocyticMesothel:** Differential Diagnosis between Astrocytic Tumors, Mesothelioma Non-sarcomatous and Sarcomatous Mesothelioma.
6. **AstrocytomaSeven:** Differential Diagnosis Between seven different astrocytomas.
7. **AstrocytomaSevenBilbao:** Differential Diagnosis Between seven different astrocytomas after regression methods (J. Bilbao)**AstrocytomaSeven2:** For this Decision making program **750 human Astrocytomas** were analyzed (WHO Grade I-II-III.) Differential Diagnosis Between seven different astrocytomas.
8. **AstrocytomasGradoBilbao:** Differential Diagnosis of 4 grades by astrocytomas after regression methods (J. Bilbao)
9. **ChoridMeningiom:** Differential Diagnosis of Choroid Plexus papilloma, Papillary Meningioma and Epitheloid Schwannoma.

10. **ChroroidPlexus**: Differential Diagnosis of Choroid Plexus Carcinoma: Choroid plexus Carcinoma, Medulloepithelioma, Embryonal Carcinoma and Choriocarcinoma.
11. **ChroroidPlexus2**: Differential Diagnosis of Choroid Plexus Carcinoma and Carcinoma-NOS.
12. **ChroroidPlexus3**: Differential Diagnosis of Choroid Plexus Carcinoma, Carcinoma-NOS and Ovarian Carcinoma
13. **ChoroidPlexusThyroid**: Differential Diagnosis of Choroid Plexus and Thyroid Papillary Carcinoma.
14. **ClearCellPrimary**: Differential Diagnosis of Central Neurocytoma, Oligodendroglioma and Clear Cell Ependymoma
15. **EpendSurvival**. Intracranial Ependymomas of Childhood. Survival analysis.
16. **EpendyChorChon**: Differential diagnosis between Ependymoma, Chordoma and Chondrosarcoma.
17. **EpendyChorMenin**: Differential diagnosis between Ependymoma, Chordoma and Meningioma
18. **Ependymoma10**. Intracranial ependymomas of Childhood.
19. **Ependymoma98**. Diagnosis of human ependymomas with the help of „MEDES“
20. **EpendymomasFourTypes**: Differential diagnosis between Ependymoma, Mixopapillary Ependymoma, Subependymoma and Anaplastic Ependymoma.
21. **EpendymomaFourTypes**: Differential diagnosis between Ependymoma, Mixopapillary Ependymoma, Subependymoma and Anaplastic Ependymoma
22. **EpendymomaThreeGrades**. Three Grade of Ependymomas after WHO. Method of Regression after J. Bilbao.
23. **EwingNeuroblastom**: Neuroblastoma versus Ewing's sarcoma.
24. **FibroSchwannNeurofibr**: Fibroma, Schwannoma and Neurofibroma.
25. **GerminLymphoma**: Germinoma versus Lymphoma.
26. **Germinoma**. Germinoma versus Teratoma, Yolk Sac Tumor, Embryonal Carcinoma and Choriocarcinoma.
27. **Gistneurofibroma**: Differential diagnosis between GIST and Neurofibroma
28. **Glioblastomasdifferent**: Differential diagnosis of four types of Glioblastomas: isomorphic, polymorphic, giant cells and gliosarcomas.
29. **GlioblastomasFiveTypesBilbao**: Differential diagnosis of four types of Glioblastomas: isomorphic, polymorphic, giant cells, gliosarcomas and gliomatosis.
30. **Glioblastuberleben**: Survival-Probabilities of Glioblastomas.
31. **GliomaNonGliomas**: Differential diagnosis between Glioma and Non-glioma in the Brain.
32. **GRADO-HISTO**: To learn the grading of Tumors.
33. **GRADO-IGL: HISTOLOGICAL GRADING OF BRAIN TUMORS)**
34. **Gradoprogres**. HISTOLOGICAL GRADING OF BRAIN TUMORS -Intraoperative diagnosis.
35. **HemangioblasPeriHisto**: Hemangioblastoma versus Hemangiopericytoma. Histological diagnosis.
36. **HemangioblastEndotel**: Differential Diagnosis Between Hemangioblastoma versus Hemangi endothelioma.
37. **Hemangioblastoma**: Differential Diagnosis Between Hemangioblastoma and Renal Cell Carcinoma.
38. **Hemangioblastpericy**: Hemangioblastoma versus Hemangiopericytoma.
39. **Hemorragia-2**. Prognosis of cerebral hemorrhages
40. **HemorrhageCNS**. Prognosis of Intracerebral Hemorrhages with the Help of MEDES.
41. **Hypermethylation**: The O⁶-methylguanine-DAN Methyltransferase as Predictor of the Survival in Patients with Low-grade Diffuse Astrocytomas.

42. **Hypophysenadenoma:** Pituitary adenoma versus Adenocarcinoma NOS
43. **LowGradeSurv: (Information page)** Survival Rates in Patients with Low-Grade Glioma.
44. **Lymphomchemo:** Chemotherapy and Survival and Recurrence of Lymphomas the CNS.
45. **MedulloblastomeThreeTypes:** Differential diagnosis between medulloblastoma, desmoplastic medulloblastoma and Medulloepithelioma.
46. **MedulloCarcinoma:** Medulloblastoma versus undifferentiated Carcinoma NOS and Small Cell Carcinoma of the Lung.
47. **Medulloepithelioma:** Differential Diagnosis of Medulloepithelioma
48. **MedulloGermEmbr:** Differential Diagnosis of Medulloblastoma versus Embryonal Carcinoma and Germ-Cell Tumor NOS.
49. **MedulloSurvival:** Survival of Medulloblastomas after Calbindin-D_{28k} Reaction
50. **MeningCarcinoma:** Meningioma versus Carcinoma undifferentiated NOS
51. **MeningiomaHemangioperi:** Meningioma versus Hemangiopericytoma.
52. **MeingiomaCarcinoma:** Meningioma versus Carcinoma undifferentiated NOS.
53. **MenigiomaFibroma:** Differential Diagnosis between Meningioma and Fibroma.
54. **Meningiomas:** Differential diagnosis Between Meningioma and Neurinoma
55. **Meningiomas-2-Meningiome Rezidive:** Recurrent Meningiomas.
56. **MeningoSpindel:** Differential Diagnosis between Meningioma, Neurinoma, Myofibroblastoma, Leiomyoma and Solitary Fibrous Tumor
57. **MeninHemablasPeri:** Meningioma versus Hemangioblastoma und Hemangiopericytoma.
58. **MeningHumanPeriHisto:** Meningioma versus Hemangiopericytoma. Only Histology.
59. **MeninMesothelSarco:** Meningioma versus Mesothelioma Sarcoma and Fibrohistiocytic Tumours.
60. **MeningiomRezidiv:** Recurrence of Meningiomas in our experience.
61. **MeningioPapillar:** Papillary Meningioma, Papillary Schwannoma versus Choroid Plexus Tumor.
62. **MeningKeratina.** Differential Diagnosis of the Meningiomas with Keratins
63. **MeningRezidive-2:** Recurrence of Meningiomas.
64. **MeninHemangioperi:** Meningioma versus Hemangiopericytoma.
65. **MeningoSpindle:** Differential diagnosis between Meningioma, Neurinoma, Myofibroblastoma, Leiomyoma and Solitary Fibrous Tumor.
66. **MetastaBreast:** 5-Years Survival in Patients with Brain Metastasis of Breast Carcinoma in the Central Nervous System.
67. **NeuroblasGang:** Diagnosis of human Neuroblastomas and Ganglioneuroblastomas with the Help of MEDES.
68. **Neuroblastoma2:** Neuroblastoma versus Ewing's sarcoma
69. **Neuroblastoma3.** Neuroblastoma, Ewing's sarcoma versus Lymph-Leuko-Lymphoma.
70. **Neuroblastomas:** Differential diagnosis between Neuroblastomas and Ganglioneuroblastomas.
71. **EwingNeuroblastom:** Neuroblastoma versus Ewing's sarcoma.
72. **NeuroblastomSurvival:** probabilities of survival by neuroblastomas
73. **NeuroblastomStromaPoor:** Prognostic value in Neuroblastoma (Schwannian stroma-poor).
74. **NeuroblastomSurvival:** probability of survival by neuroblastomas.
75. **Neuroblastrecurrence:** Risk of Recurrence in Neuroblastoma.
76. **NeuroblastWilms:** Neuroblastoma versus Wilms Tumor.

77. **Neurofibromas.** Diagnosis of human Schwannomas, Malignant Schwannomas, Neurofibromas and Neurofibrosarcomas with the help of MEDES.
78. **Oligoastros.** Differential Diagnosis between Oligodendrogliomas and Astrocytomas.
79. **OligoDysembry:** Differential Diagnosis between Dysembryoplastic Tumor and Low Grade Oligodendroglioma.
80. **OligoGradoBilbao:** Differential Diagnosis of 2 grades by Oligodendrogliomas (WHO Grade II and Grade III) after Regression methods (J. Bilbao). Based on our experience of 597 Oligodendrogliomas.
81. **OligoMalig_Bening.** Differential Diagnosis between benignant (WHO II) and Malignant Oligodendrogliomas (WHO III).
82. **Oligo-Oligoastros.** Differential Diagnosis between Oligodendrogliomas (WHO II) and Oligoastrocytomas (WHO II).
83. **OligoThreeTypes:** Differential Diagnosis of three types grades by Oligodendrogliomas (WHO Oligodendroglioma, Oligoastrocytoma and Anaplastic Oligodendroglioma) after Regression methods (J. Bilbao). Based on our experience of 597 Oligodendrogliomas.
84. **ParkinsonDementia:** Differential Diagnosis of Parkinson's Diseases.
85. **Pinealis:** Differential Diagnosis of Pinealis Tumours
86. **PNET.** Neuroblastoma, PNET versus Ewing's Sarcoma.
87. **PNET-Ewingsarc:** PNET versus Ewing Sarcoma.
88. **PNETNeuroWILMS:** PNET_Ewings, Neuroblastoma and WILMS Tumor.
89. **RacialDifferences:** Racial Differences of the Primary Malignant Brain Tumors?
90. **Rhabdoid-PNET:** Differential Diagnosis of PNET and Teratoid/Rhabdoid Tumor.
91. **SchwannFibromNeurofib:** Differential Diagnosis between Schwannoma, Neurofibroma and Fibroma
92. **SchwannGlioma:** Differential Diagnosis between Schwannoma and Glioma.
93. **SchwannMPSacomas.** Schwannoma versus MPNST (Malignant Peripheral Nerve Sheath Tumor and Sarcoma MFH).
94. **SchwannNeurofibrom:** Differential Diagnosis between Schwannoma and Neurofibroma with the help of antibodies.
95. **SchwannNeurofibromAntibodies:** Schwannoma versus Neurofibroma with the of Antibodies.
96. **SchwannomaNeurfibromBilbao:** Differential Diagnosis between Schwannoma and Neurofibroma after a Regression Method of J. Bilbao
97. **SchwannomaMPNST.** Schwannoma versus MPNST (Malignant Peripheral Nerve Sheath Tumor-
98. **SchwannMPSSarcomas:** Schwannoma versus MPNST (Malignant Peripheral Nerve Sheath Tumor and Sarcoma MFH
99. **Schwannomas:** Differential Diagnosis between Schwannomas, Meningioma and Fibroma
100. **SchwannomasWhoGrade:** Differential Diagnosis between Grade 1 and Grade 3 of Schwannomas and Neurofibromas.
101. **Sellartumors:** Endocrine tumors of the pituitary.
102. **SpinalMetastasis:** Clinical Outcome and Survival after Palliative Surgery for Spinal Metastases
103. **Subependymal:** Differential Diagnosis between Giant cell Astrocytoma and Gemistocytic Astrocytoma
104. **SurvivalLow-Grade:** Survival Rates in Patients with Low-Grade Glioma. Table DOC-Document.
105. **SchwannNeurofiFibroma:** Schwannoma versus Neurofibroma and Fibroma.

106. **Xantastrocytoma:** Differential Diagnosis between Pleomorphic Xantastrocytoma, Pilocytic Astrocytoma, Ganglioglioma and Giant Cell Glioblastoma.

Neuroradiology (5)

1. **EspectroGlioma:** Differential Diagnosis of Intracranial Process with 1H-MR-Spectroscopy.
2. **TumorAdult:** Diagnosis of Brain Tumours of adults by computer tomography.
3. **TumorChlid:** Diagnosis of Brain Tumours of adults by computer tomography.
4. **TiaStroke.** A Prospective Analysis of risk factor and differential diagnosis of TIA-like, True-TIA, Stroke-Like and True-Stroke.
5. **Trauma.** Prognosis of Brain Trauma.