

German Research Center for Artificial Intelligence

# A digital pen-based tool for instant digitisation and digitalisation of biopsy protocols

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### Background

- Patients who received a kidney transplant undergo a lifelong treatment with routine check ups every 3 months.
- Biopsies can exclude or confirm a organ rejection: a small tissue sample is removed from the kidney and preserved.
- Pathologists examine the tissue under a microscope and assess the results using the Banff classification.
- Until now biopsy protocols are created using pen & paper with



manual transcription.

#### Our approach

- Improve medical processes in nephrology.
- Allow doctors to create biopsy protocols by using a digital pen on a tablet.
- Real-time hand-writing/gesture recognition & real-time feedback on recognition results.
- Direct digitisation into structured data and PDF.
- Mapping of transcribed content into concepts of the Banff classification.
- Fully digital solution enables seamless integration into existing hospital processes.

| Banff 09 categories         1       1   |   | PAGE 1 PAGE 2  |         |
|---|---|--|---------|
| Banf 09 ABM changes       Chronic active antibody mediated rejection         I       III       indeterminate       chronic active antibody mediated rejection         Banf 09 COMR Type/Grade (acute rejection)       Image: Ima  |   | Banff 09 categories  |         |
| Banff 09 TCMR Type/Grade (acute rejection)       Image: Comparison of the second of the |   | Banff 09 ABM changes   |         |
| Chronic-transplant Nephropathy       Pyelonephritis       BKV       CMV         Image: Construction of the problem of the phropathy       Image: Construction of the phropathy       Image: Construction of the phropathy         Image: Construction of the phropathy       Image: Construction of the phropathy       Image: Construction of the phropathy       Image: Construction of the phropathy         Image: Construction of the phropathy       Image: Construction of the phropathy       Image: Construction of the phropathy       Image: Construction of the phropathy         Image: Construction of the phropathy   |   | Banff 09 TCMR Type/Grade (acute rejection) Borderline Ia Ib III III Chronic active T-cell mediated rejection   |         |
| non-rejection diagnosis   |   | Chronic-transplant Nephropathy<br>Glomerulosclerosis Pyelonephritis BKV CMV Nephropathy Nephropathy  |         |
|   | U | non-rejection diagnosis         Post-transplant lymphoproliferative disorder         Nonspecific focal intersitial inflammation without tubulitis         Nonspecific reactive vascular changes         Nonspecific reactive vascular changes         Nonspecific venulitis         Acute tubular necrosis         Acute interstitial nephritis         Cyclosporine or FK506-associated changes, acute or chronic Subcapsular injury         Pretransplant acute endothelial injury         Papillary necrosis         De novo glomerulonehpritis         Recurrent disease immune complex glomerulonehpritis         Recurrent disease focal segmental glomerulosclerosis         Recurrent disease diabetes         Recurrent disease other         Pre-existing disease         Viral infection         Obstruction/reflux, urine leak | SAMSUNG |
| "100"   |   | "100"  |         |

Integration into existing hospital processes

# Implementation

- Samsung Android Tablet with integrated Wacom Stylus (pressure etc.)
- MyScript® handwriting and shape recognition engine
- Gesture recognition and information extraction using Artificial Intelligence techniques
- Digitisation into structured data (XML, JSON etc.) and PDF documents



Pen-based tablet application

## **TBase**®

- Medical database for patients with kidney transplants.
- Created 1999 by Charité in cooperation with Humboldt University of Berlin.
- Supports not only routine check ups but also gathers and provides data for scientific research.
- TBase® contains 3.945 patients, 550.000 laboratory cases, 146.000 examination findings and 237.000 medication plans.
- Our application directly connects to TBase® by getting patient data and writting back the structured results.

**Project:** 







**Contact:** DFKI GmbH Research Department Intelligent User Interfaces

