Pacer: Fine-grained Interactive Paper via Camera-touch Hybrid Gestures on a Cell Phone. Liao, et al. CHI. 2010.

What are the core research questions addressed by the work?

- Enabling fine-grained manipulation of document content and gestural interaction in an interactive mobile phone-paper system

What motivates the work?

- GUI-like interactions on paper is an active research area
- Existing practices still fall short of the goal of GUI experience on paper
    - Lack of sufficient fine-grained operations
    - Lack of gestures that offer more flexibility to manipulate document content
- Combining the merits of phones and paper for maximum user experience

How does the work understand the usage, capabilities, and limitations of paper?

- Paper still plays an important role in many tasks in the age of computers
- Paper's advantages: Display quality, spatial arrangement flexibility, instant accessibility and robustness
- Paper's disadvantages: Lacks computational capability, does not render dynamic information

What is the target application domain of the work?

- Document reading and editing

What are some proposed extensions to paper proposed by the work?

- Allow users to manipulate fine-grained document content with various gestures beyond point-and-click
    - Camera-touch hybrid input
    - Interaction with document details through a variety of gestures including marquees, lassos, vertical bars, underlines, and brackets
- Enables features: Cut & email, search text, follow hyperlinks, interpret symbolic language

How are the proposed extensions implemented?

- System is entirely implemented on a mobile device
    - Paper document recognition, tracking
- Mobile phone communicates with a PACER server
- Camera crosshair interaction

What findings have been obtained from either the implementation process or an evaluation of the proposed system?

- The system had the following design challenges that still require addressing: slow image recognition, inaccurate physical-digital document registration, hand-gitter
- The system proposed an interaction modality that might be of use to future work:
    - Use of a loose registration strategy instead of a strict registration in AR systems
    - Substitutes retrieved high fidelity document images for camera images, and does not require persistent and precise alignment between the background paper document and the screen content expect for the initial pointing for recognition

- Advantages: Works around continuous and precise registration of digital overlays with camera images, avoids low quality cell phone video, enables flexible manipulation, relieves users of repeatedly coordinating the paper and the cell phone in space