

Forensic Face Sketch Construction and Recognition

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ABSTRACT

In forensic science, it's seen that hand-drawn face sketches are still very limited and time-consuming when it involves using them with the foremost recent technologies used for recognition and identification of criminals. During this paper, we present a standalone application which could allow users to create composites face sketch of the suspect without the help of forensic artists using pick and drop feature within the appliance and will automatically match the drawn composite face sketch with the criminal database much quicker and efficiently using deep learning and cloud infrastructure.

Keywords:—

.Forensic.Face.Sketch,.Face.Sketch.Construction,.Face.Recognition,.Criminal.Identification,.Deep.Learning,.Machine.Locking,.Two.Step.Verification.

I. INTRODUCTION

A criminal may be easily identified and dropped at justice employing a face sketch drawn supported the outline been provided by the eyewitness, however during this world of modernization the normal way of hand drawing a sketch isn't found to be that effective and time saving when used for matching and identifying from the already available database or real-time databases.

During the past there are several techniques been proposed to convert hand-drawn face sketches and use them to automatically identify and recognize the suspect from the police database, but these techniques couldn't provide the desired precise results. Application to form a composite face sketch were even introduced which too had various limitations like limited face kit, cartoonist feel to the created suspect face which made it much harder to use these applications and procure the specified results and efficiency.

The above applications and wishes motivated us into thinking of making an application which might not just provide a group of individual features like eyes, ears, mouth, etc. to be selected to form a face sketch but also would allow user to upload hand-drawn individual features on the platform which might then be converted into the applications component set. This successively would make the created sketch way more the same as the hand-drawn sketch and would be much easier for the enforcement departments to adapt the applying.

Our application would even allow the enforcement team to upload previous hand-drawn sketch so as to use the platform to spot and recognize the suspect using the rather more efficient deep learning algorithm and cloud infrastructure provided by the applying.

sketches and also the database so as to suggest the user all the relatable face expression that might be used with one selected feature so as the decrease the time-frame and increase the efficiency of the platform.

II. RELATED WORK

There are lot of studies on face sketch construction and recognition using various approaches. Dr. Charlie Frowd together with Yasmeen Bashir, Kamran Nawaz and Anna Petkovic designed a standalone application, the initial system was found to be time consuming and confusing because the conventional method, later switching to a replacement approach within which the victim was given option of faces and was made to choose similar face resembling the suspect and at the best the system would combine all the chosen face and check out to predict automatically the criminal's facial composite. The Results where promising and 10 out of 12 composite

e. faces. where. named. correctly. out. of. which. the. res
ults. 21.3%. when. the. witness. was. helped. by. the. dep
artment. individual. to. work. out. the. faces. and. about.
17.3%. when. the. witness. tried. constructing. the. faces
. by. themselves.

Xiaou. Tang. and. Xiaogang. Wang. propose
d. a. recognition. method. of. that. could. synthesis. a. giv
en. sketch. into. photo. or. a. given. photo. in. to. sketch. s
o. search. the. database. for. a. relevant. match. for. this. t
he. model. divided. the. face. sketch. in. to. patches. .duri
ng. this. they. first. synthesized. the. available. photos. in
. to. sketch. then. trained. the. model. making. the. model.
to. decrease. the. difference. between. photos. and. sketc
h. this. enhanced. the. efficiency. of. the. popularity. mo
del. For. testing. this. they. took. few. samples. during.
which. the. photos. where. synthesized. in. to. sketch. and
also. the. identical. faces. were. drawn. from. sketch. a
rtist. that. the. model. was. trained. from. 60% .data. and.
remaining. 40% .data. for. testing. the. model. the. final
results. where. impressive. but. not. up. to. the. mark. evi
dently.

The. algorithm. first. converts. the. face. photo
s. using. linear. transformation. which. was. supported.
Tang. and. Wang. proposed. model. then. the. sketch. wa
s. accustomed. measure. the. SIFT. .descriptor. distance
. compared. to. the. face. photo. and. in. some. cases. dista
nce. between. images. within. the. databases. too. were.
measured. for. better. accuracy. . The. experimental. res
ult. shows. that. the. dataset. used. where. very. a. bit. like
. the. those. employed. by. Tang. within. their. experime
nt. and. so. the. addition. within. the. algorithm. was. the.
measurement. of. the. descriptor. which. gave. a. way. be
tter. result. and. accuracy. from. the. model. proposed. b
y. Tang. and. Wang.

P. C. Yuen. and. C. H. Man. also. hints. a. tec
hnique. of. . working. to. diagnose. human. faces. using.
sketches. , this. method. converted. sketches. to. mug. sh
ots. hence. matching. those. mugshots. to. faces. Howe
ver. , in. some. cases. the. mugshots. where. hard. to. be.
matched. with. the. human. faces. within. the. databases.
like. FERET. Database. and. Japanese. Database. . The.
proposed. method. showed. an. accuracy. of. about. 70
% . within. the. experimental. results. , which. was. fair. d
ecent. but. still. lacked. the. accuracy. needed. by. the. en
forcement. department. .

The. common. issue. with. all. the. proposed. a
lgorithm. where. . that. they. compared. the. face. sketch
es. with. face. which. were. . usually. front. facing. makin
g. it. easier. to. be. mapped. both. in. . drawn. sketch. and. e
xternal. piece. photograph. , but. when. a. photograph. or
. sketch. collected. had. their. faces. in. numerous. directi
on. the. algorithms. were. less. likely. to. map. it. and. co
mpare. with. a. face. from. the. put. forth. database. whic
h. contains. frontal. sketches. .
There. are. even. system. been. proposed. for. composit

e. face. . construction. but. most. system. used. facial. fea
tures. which. where. been. taken. from. photographs. so.
been. selected. by. the. operator. as. per. described. by. th
e. witness. and. eventually. complied. to. . create. one. fa
ce. making. it. much. more. complicated. for. human. . sti
ll. as. any. algorithm. to. match. it. with. a. criminal. face
as. every. facial. feature. was. been. taken. from. the. sep
arate. face. photograph. having. various. dissimilarity. a
nd. when. combined. together. . made. it. harder. to. ackn
owledge.

Thus. , all. the. previous. approaches. proved. either. inef
ficient. or. time. consuming. and. complex. . Our. applic
ation. as. mentioned. above. wouldn't. only. overcome. t
he. restrictions. of. the. mentioned. proposed. technique
s. but. would. also. fill. within. the. gap. between. the. trad
itional. hand-
drawn. face. sketch. technique. and. new. modernized. c
omposite. face. sketch. technique. by. letting. user. to. up
load. the. hand-
drawn. face. sketches. and. countenance.

III. OVERVIEW AND FEATURES

A. Security and Privacy

The. major. concern. of. the. law. enforcement
. department. before. adapting. any. system. is. security.
and. privacy. . Keeping. this. in. mind. the. application. is
. designed. to. be. protect. the. privacy. and. carry. out. the
. security. measures. in. the. following. way.

a) **Machine Locking:** The. Machine. locking. t
echnique. would. confirm. that. the. applying. once. inst
alled. on. a. system. couldn't. be. tampered. and. may. not
. been. operated. on. the. other. system. , that. the. applian
ce. uses. two. locking. parameters. i. e. , one. software. a
nd. one. hardware. locking. parameter. .
NET. ID. - Hardware. ID. - MAC. Address.

b) **Two Step Verification:** Every. law. enforc
ement. authorized. user. would. be. given. an. official. E-
Mail. ID. which. would. use. to. login. on. to. the. applicat
ion. , thus. using. this. step. would. require. the. user. to. e
nter. a. random. code. been. shared. with. them. on. their.
mobile. / desktop. in. order. to. complete. the. logging. pr
ocess.

c) **Centralized Usage:** The. application. woul
d. be. placed. on. a. system. that. was. connected. to. a. cen
tralized. server. on. the. law. enforcement. department's
. campus. that. included. the. database. and. other. critica
l. features. of. the. application; hence. , the. application.
could. not. be. used. if. the. server. was. unplugged.

d) **Backward Compatibility**

The. major. drawback. in. adapting. any. new. system. is
. that. the. complication. been. involved. in. completing.

migrating from the previous technique to the new technique, hence leading to the wastage of your time resources.

To overcome this issue, we've got designed our application in such the simplest way that even the hand-drawn sketches may be uploaded and therefore the user can use the deep learning algorithms and cloud infrastructure to spot and recognize the criminal using the hand-drawn sketch.

C. Face Sketch Construction using Drag and Drop

In this application, accurate composite face sketch is constructed using the predefined facial feature sets provided as tools allowing to be resized and repositioned as per requirement/described by the eye-witness.

Here, the external body part is categorized into various face expression like head, eyes, eyebrow, lips, nose, ears, etc. and a few important wearable components like hats, specs, etc. too are been available within the application to be used.

Every facial feature when selected would open a large range of options to settle on from supported the requirement/description of the eye-witness. The machine learning algorithm would learn and in future attempt to suggest all the face expression which could suit the only selected feature and would attempt to help in completing the composite face sketch much sooner and far efficiently.

Fig. 1..Shows the sketch of the facial feature viz..Head
 Fig. 2..Shows the sketch of the facial feature viz..Eyes
 Fig. 3..Shows the sketch of the facial feature viz..Ears



Fig. 1..Face.Feature.–.Head



Fig. 2..Face.Feature.–.Eyes



Fig. 3..Face.Feature.–.Ears

Such are the face expression which might be employed in the applying to form the composite face sketch of the suspect supported the outline been provided by the eye-witness to the enforcement and forensic department.



Fig. 4..User.Interface.of.the.application.(with.blank canvas)



Fig. 5..User.Interface.of.the.application (With facial features been dragged onto the canvas)

The Fig. 4..shows the computer programme of the appliance been presented to make composite facial sketch with the set of facial expression on the right-hand side to be selected and tools for resizing, repositioning, saving, etc. are on the left-hand side. Fig. 5..shows the programme of the applying with the facial feature been dragged on to the canvas from the right-hand side and to be used with other facial expression to form a composite face sketch.

D. System.Flow

The Fig. 6. illustrates the flow of the system starting with the login section which ensuring the two-step verification process. Further the appliance can either be used with a hand-drawn sketch or a composite face sketch may be created using the drag and drop feature, either of the

photographs would then go under features extraction process which might help the appliance to use image processing and computer vision algorithm and eventually match the sketch with the database and so display the ratio of similarities between the sketch and therefore the database photograph.

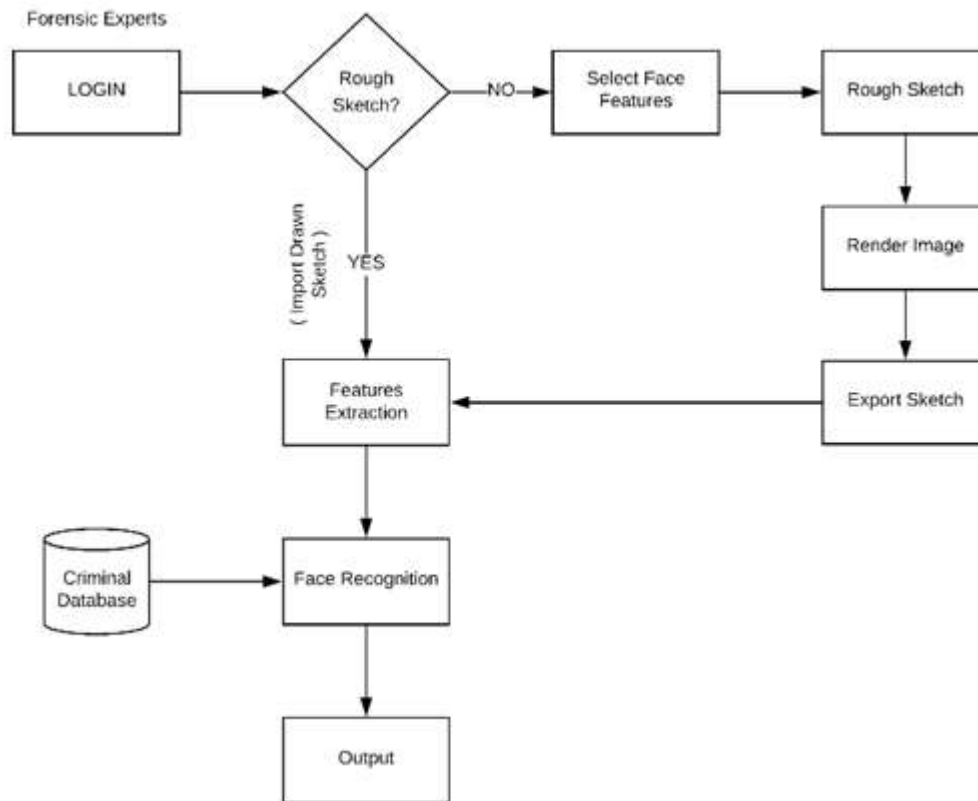


Fig. 6..System.Flow.of.the.application

IV. OVERVIEW.AND.FEATURES

In this application, Operations is performed in two stages.

A. Face.Sketch.Construction:

The flowchart illustrates the users flow been followed by the platform to provide an construct accurate

face sketch based on the description, the dashboard is designed simple in order to encourage no professional training to go through before using this platform already saving the timeframe which would have been taken a lot time and resources of the Department.

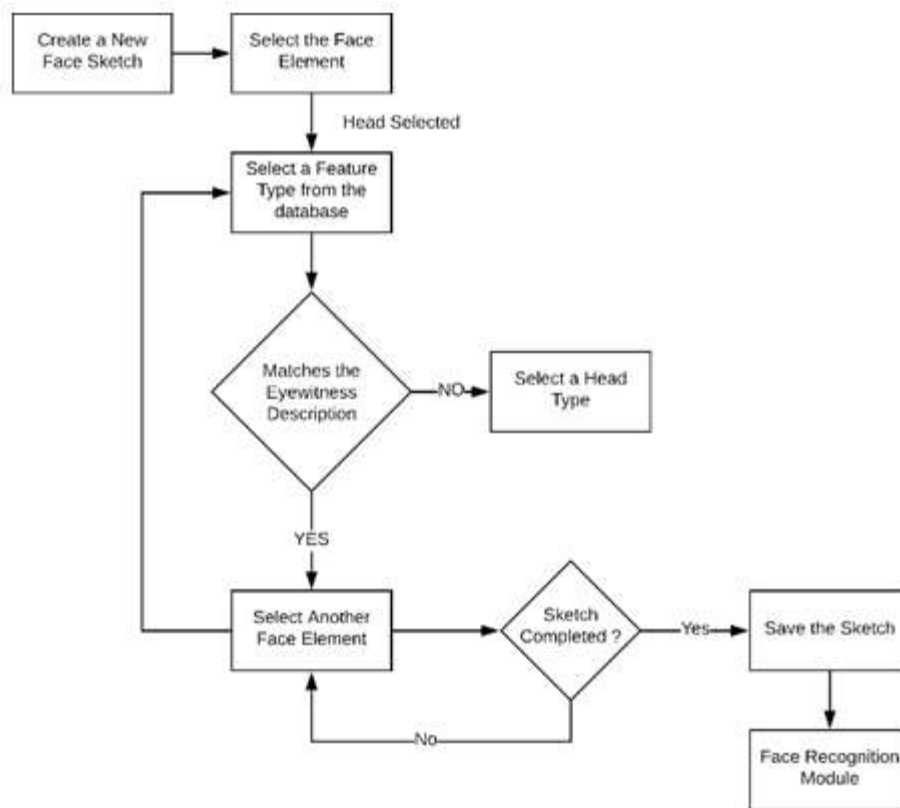


Fig..7..Flow Chart.for.Creating.a.sketch.in.the.application.

The dashboard consists of 5 main modules. First, the important module is that the Canvas been shown at the center of the dashboard which might house the face sketch components and also the elements of the face sketches helping within the construction of the face sketch.

Creating the face sketch would be an advanced thing if all the face elements are given all at once and in an unordered manner making the method difficult for the user and sophisticated to construct an accurate face which might be against the agenda aimed within the proposed system. So, to beat this issue we planned on ordering the face elements supported the face category it belongs to like head, nose, hair, eyes, etc. making it much easier for the user to interact with the platform and construct the face sketch. This is often available within the column within the left on Canvas on the dashboard click on a face category allows user to urge various other face structure.

Coming to the varied face elements during a particular face category we could have multiple and number of elements for one category, so to resolve this our platform would use machine learning in future to predict the similar face elements or predict an suggest the weather to be selected within the face sketch but this may only work once we've appropriate

data to coach the model on this algorithm and work to reinforce the platform.

So, now when the user clicks on a specific face category then a brand new module to the proper of the canvas opens and lets user to pick part from the choice of face elements to construct a face sketch. This feature is often selected be supported the outline provided by the attention witness.

The elements when selected are shown on the canvas and might be moved and placed as per the outline of the attention witness to urge a more robust and accurate sketch and also the elements have a hard and fast location and order to be placed on the canvas just like the eye elements would be placed over the top element no matter the order they were selected. Same for each face element.

The final module is that the options to reinforce the employment of the dashboard, suppose in cases the user selects a part which isn't to be selected in order that may be rectified using the choice to erase that exact element which might be seen when selecting the face category from the left panel. The foremost important buttons are placed within the panel on the proper which features a button to completely erase anything on the canvas of the dashboard making it totally blank.

Then we've got a button to avoid wasting the constr

ucted..face.sketch,.saving.the.face.sketch.as.a.PNG.
 file.for.better.future.access..this.might.be.any.locati
 on.on.the.host.pc.or.on.the.server.counting.on.the.e
 nforcement.Department.

ed.by.the.platform.to.produce.an.recognize.accurate
 .face.sketch.supported.the.outline,.the.dashboard.is.
 intended.simple.so.as.to.encourage.no.professional.
 training.to.travel.through.before.using.this.platform
 .already.saving.the.timeframe.which.might.are.take
 n.plenty.time.and.resources.of.the.Department.

B. Face.Sketch.Recognition:

The.flowchart.illustrates.the.users.flow.been.follow

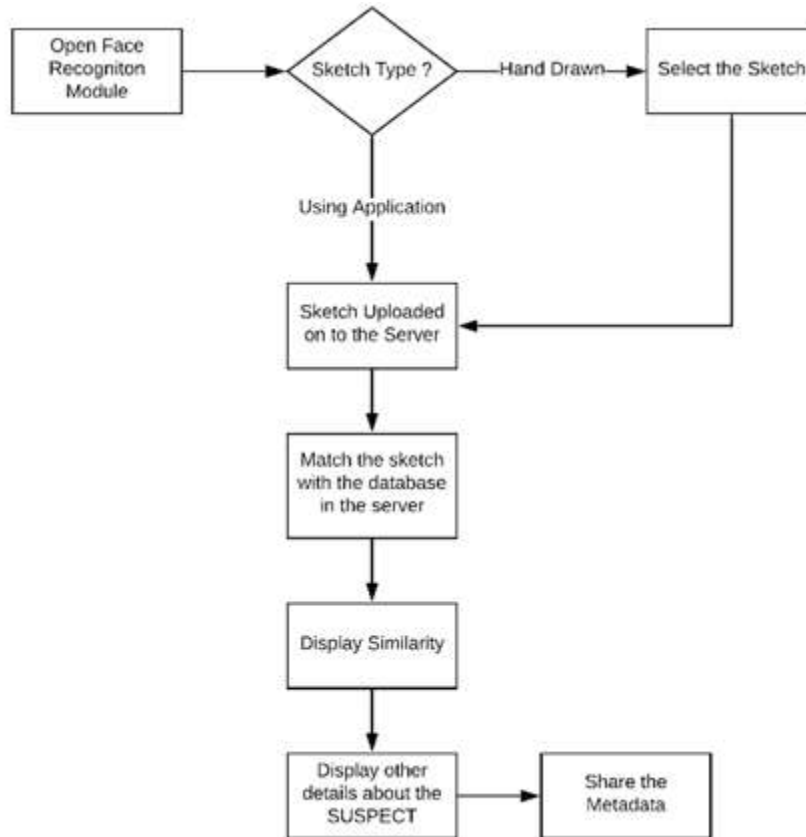


Fig..8..Flow.Chart.for.Recognizing.a.sketch.in.the.application

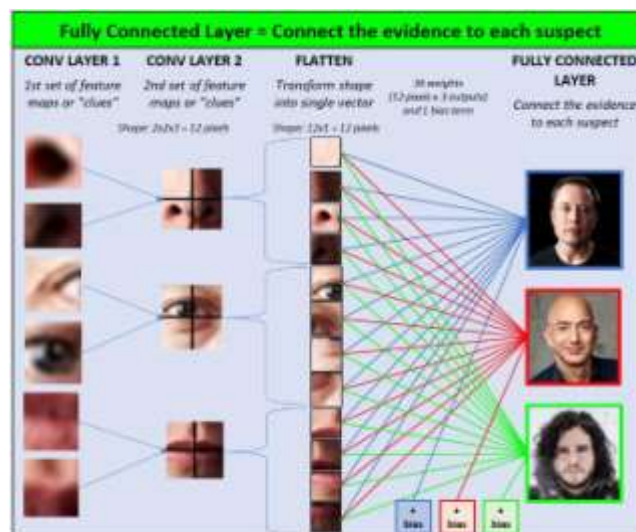


Fig..9..Feature.extraction.by.the.Platform

The above image demonstrates the primary part before using the platform to acknowledge faces is making the present records in with the enforcement department suitable for our platform by training and making the platforms algorithm recognize and assign IDs to the face photo to the user within the existing records in with the enforcement department. For this the platforms algorithms gets connected to the records and breaks each face photo in to numerous smaller features and assign an ID to the multiple features generated for one face photo. Now, the Module which is majorly designed to be run on the Law enforcements server for security prot

ocols, is been executed where within the user first opens either the hand drawn sketch or the face sketch constructed on our platform.... saved within the host machine, after which the opened face sketch is been uploaded to the Law enforcements server housing the popularity module in order that the method or the info of the record aren't tampered and are secure and accurate. Once the sketch is uploaded on to the server the algorithm first traces the sketch image so as to be told the features within the sketch and map the features as shown within the below figure so as to match those with the features of the face photos within the records.



Fig. 10..Face Sketch been mapped on the Platform

After mapping the sketch and matching the face sketch with the records and finding a match the platform displays the matched face together with the similarity percentage and other details of the pe

erson from the records. The platform displaying all this and therefore the matched person is shown within the below figure.



Fig. 11..Face Sketch matched to Database Record

V. RESULTS & CONCLUSION

The Project 'Forensic Face Sketch Construction and Recognition' is been designed, developed and eventually tested keeping the realworld scenarios from the very first splash screen to the ultimate screen to fetch data from the records keeping security, privacy and accuracy because the key think about every scenario The platform displayed an incredible result on Secu

rity point of view by blocking the platform use if the MAC Address and IP Address on load didn't match the credentials related to the employment within the database and later the OTP system proved its ability to limit the use of previously generated OTP and even generating the new OTP when the OTP page is reloaded or the user tries to relog within the platform. The platform even showed good accuracy and speed

d.while.face.sketch.construction.and.recognition.pr
ocess,.provided.a.median.accuracy.of.over.90%.wit
h.a.confidence.level.of.100%.when.tested.with.vari
ous.test.cases,.test.scenario.and.data.sets,.which.su
ggests.a.awfully.good.rate.consistent.with.related.st
udies.on.this.field.

The.platform.even.has.features.which.are.different
and.unique.too.when.put.next.to.related.studies.on
this.field,.enhancing.the.security.and.accuracy.by.st
anding.out.among.all.the.related.studies.and.propo
sed.systems.during.this.field.

VI. FUTURE SCOPE

The.Project.‘Forensic.Face.Sketch.Constr
uction.and.Recognition’.is.currently.designed.to.fig
ure.on.only.a.few.scenarios.like.on.face.sketches.an
d.matching.those.sketches.with.the.face.photos.wit
hin.the.enforcement.records.

The.platform.may.be.much.enhanced.with
in.the.future.to.figure.with.various.technologies.and
.scenarios.enabling.it.to.explore.various.media.and
surveillances.medium.and.acquire.a.far.wider.sprea
d.and.outputs,.The.platform.is.modified.to.match.th
e.Face.sketch.with.the.human.faces.from.the.video.
feeds.by.using.the.3D.mapping.and.imaging.techni
ques.and.same.will.be.implemented.to.the.CCTV.s
urveillances.to.perform.face.recognition.on.the.Liv
e.CCTV.footage.using.the.Face.Sketch.

The.platform.can.further.be.connected.to.s
ocial.media.has.social.media.platforms.acts.encom
passes.a.rich.source.for.data.in.today’s.world,.this.s
ystem.of.connecting.this.platform.with.the.social.m
edia.platform.would.enhance.the.power.of.the.platf
orm.to.seek.out.a.way.more.accurate.match.for.the
face.sketch.and.making.the.method.way.more.accur
ate.and.speeding.up.the.method.

All.told.the.platform.could.have.features
which.may.well.be.different.and.unique.too.and.si
mple.to.upgrade,.when.put.next.to.related.studies.o
n.this.field,.enhancing.the.security.and.accuracy.by
standing.out.among.all.the.related.studies.and.prop
osed.systems.during.this.field.

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